AD-A113 088 IRT CORP SAN DIEGO CA F/G 9/1
A LITERATURE SURVEY ON INVERSE SCATTERING FOR ELECTRON DENSITY --ETC(U)
SEP 81 W R STONE F19628-80-C-0187
UNCLASSIFIED IRT-8205-003-VOL-2 AFGL-TR-81-0282-2 NL

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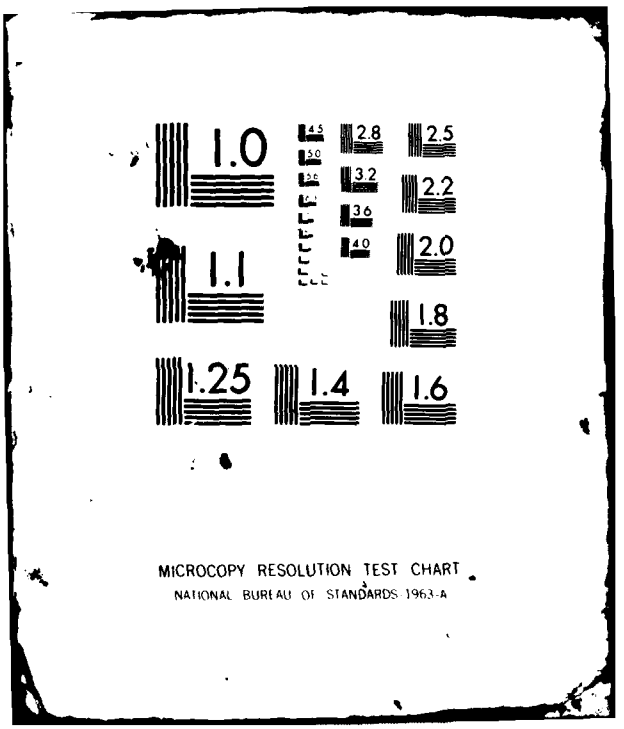
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MICROCOPY RESOLUTION TEST CHART
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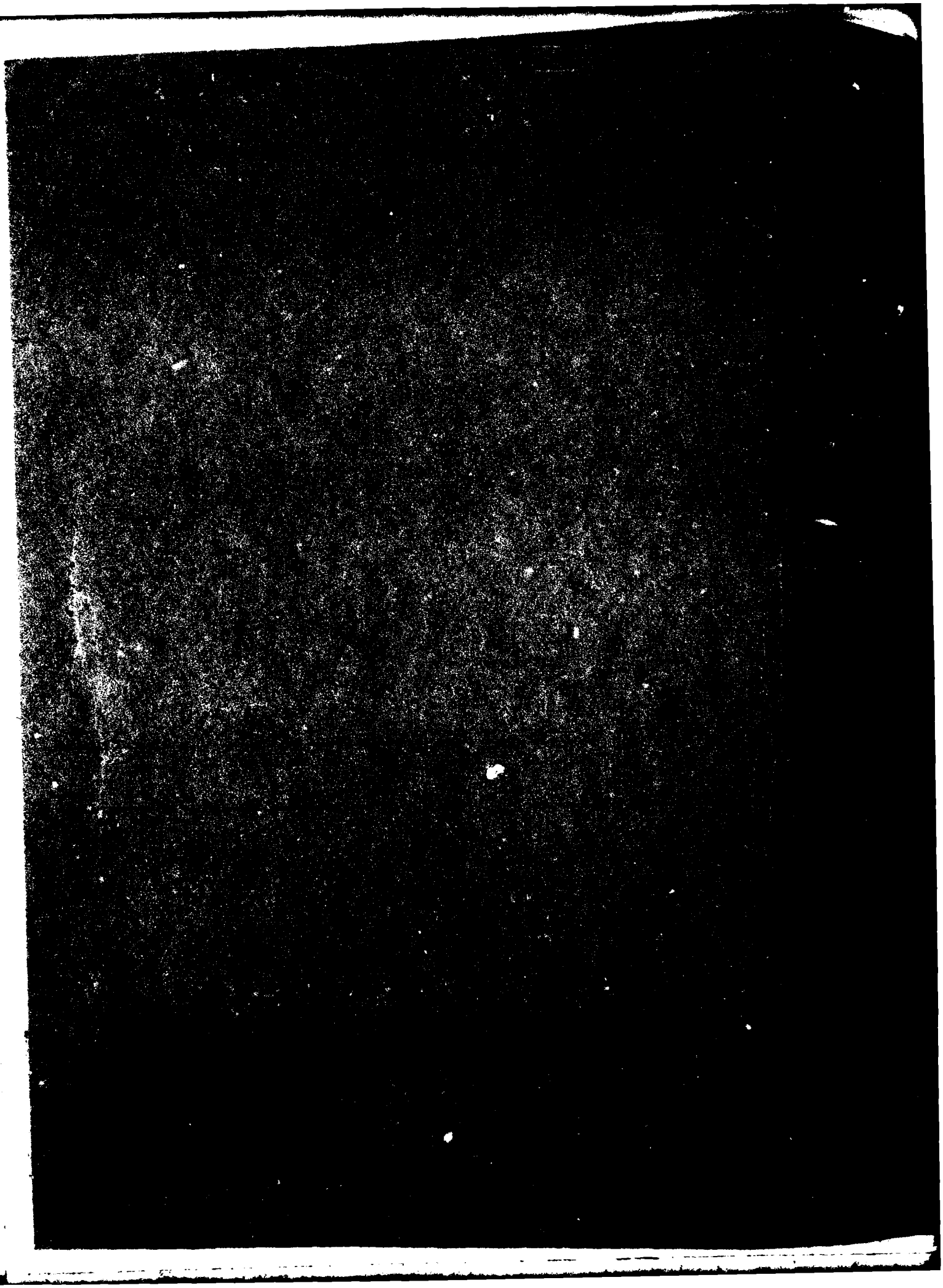

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFGL-TR-81-0282(II)	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A LITERATURE SURVEY ON INVERSE SCATTERING FOR ELECTRON DENSITY PROFILE DETERMINATION Volume II		5. TYPE OF REPORT & PERIOD COVERED Final Report 8/28/80-10/30/81 6. PERFORMING ORG. REPORT NUMBER IRT 8205-003
7. AUTHOR(s) W. Ross Stone		8. CONTRACT OR GRANT NUMBER(s) F19628-80-C-0187
9. PERFORMING ORGANIZATION NAME AND ADDRESS IRT Corporation 7650 Convoy Court, P. O. Box 80817 San Diego, California 92138		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 61102F 2310G6AB
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory Hanscom AFB, Massachusetts 01731 Monitor/Milton M. Klein/PHY		12. REPORT DATE 24 September 1981 13. NUMBER OF PAGES 52
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Inverse scattering Ionosphere Electron density profile Inverse source problem Nonradiating sources Literature survey		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) An extensive literature survey on the field of inverse scattering as it applies to determining the spatial distribution of electron density in the ionosphere is presented. The references are primarily from the period 1970-1981. Abstracts are included.		

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INTRODUCTION

One of the tasks identified at the start of the research reported in this paper was to do a literature survey on the problem of applying inverse scattering techniques to determine the electron density distribution in the ionosphere. The primary motivation for this survey was to ensure that no potentially useful technique was overlooked in making the decision as to which approach to pursue.

The author has been professionally active in the inverse scattering and ionospheric probing fields for over 13 years. During this time, he has accumulated a library of over 1000 papers, reports, and books related ot the topic of this survey. The first step in the survey was to review this library and extract those references which satisfied one or more of the following criteria:

1. The reference presents the fundamental information or an important aspect about an inverse scattering technique which was potentially applicable to the problem of interest.
2. The reference presents an inverse scattering technique which is well known, but is not applicable for one or more reasons evident from the material in the reference.
3. The reference includes material of interest in connection with the Exact Inverse Scattering Theory and related approaches discussed in this paper.
4. The reference presents material on the ionosphere of importance to applying inverse scattering theory to profile determination.

In addition, if a reference satisfied items 1, 2, and/or 4, but not item 3, then it was only included if it was felt to be "illustrative." Specifically, an attempt was made to avoid multiple references dealing with nearly identical material.

In an attempt to insure that material had not been omitted by the author, an extensive (but surprisingly inexpensive) computer aided literative search was next carried out. The following standard data bases were searched, using several nationwide systems accessed through the University of California, San Diego:

1. The Engineering Index ("Compendex")
2. The American Institute of Physics "SPIN" Index
3. The National Technical Information Service, (ITIS) index of government contract reports
4. "INSPEC"
5. Dissertation abstracts
6. The International Index of Conference Papers

These indexes are accessed using key words, singly and in combination. The numbers in Table 1 indicate the reference found in each index for each keyword. The search was carried out in November 1980. Printouts of the complete reference and abstract for Lines 1, 4, 5, 6, 9, 10, 11, 12, 13, and 14 of Table 1 were obtained. Searches on other combinations of keywords, directed toward ionospheric electron density profile determination without reference to inverse scattering resulted in matches that dealt with experimental and data processing techniques that were of little relevance to the purpose of the literature survey.

The 1032 abstracts which resulted from the above process were then examined individually, and subjected to the same selection criteria applied to the author's library. Where information in the abstract was insufficient, the original reference was consulted. All of those references chosen from the author's library were contained in the references found by the computer. This bespeaks a significant degree of exhaustiveness in the computer search. Those references in the final set with which the author was not familar were studied.

The results of the literature survey, as reported in Volume I of this paper, was that the Exact Inverse Scattering Theory and the related techniques discussed in Volume I represent the best approach to pursue.

The final set of references, after the selection procedure, along with their abstracts, is presented on the following pages. The references are in chronological order, in so far as possible.

Table 1. Acoustic or Electromagnetic Methods of Inverse Scattering

	KEY WORDS	INDEX COMPENDEX	INDEX SPIN	INDEX NTIS	INDEX INSPEC	DISSERTATIONS	CONFERENCE PAPERS
1.	Inverse Scattering	56	163	124	404	18	32
2.	Electromagnetic	11,408	3,675	12,898	26,046	942	1,322
3.	Acoustic	14,374	2,966	9,245	11,392	881	2,464
4.	Inverse Source	4	2	3	7	0	0
5.	Profile Determination	0	8	3	50	0	5
6.	Profile Reconstruction	3	0	1	7	0	0
7.	Nonradiating Source	0	0	0	0	0	0
8.	Nonscattering Potential	0	0	0	0	0	0
9.	1 Combined with 2	18	3	31	39	1	3
10.	1 Combined with 3	4	3	13	15	2	0
11.	3 Combined with 4	4	0	0	0	0	0
12.	1 Combined with 5	0	0	1	0	0	0
13.	2 Combined with 4	0	0	0	2	0	0
14.	1 Combined with 6	0	0	0	2	0	1

157341 ID NO.- EI71X057341

D- region electron concentration profile produced by the July 9, 1962 nuclear detonation

JUSICK AT; FURMAN DR

Stetson Univ, DeLand, Fla

J Geophys Res v 74 n 24 Nov 1 1969 p 5737-42 CODEN: JGREA

Three possible D- region electron concentration profiles resulting from the July 9, 1962, 'Starfish' nuclear detonation are derived, using multiple frequency measurements of the absorption of cosmic radio noise. Two methods of profile determination are used. The first method uses both the classical magnetoionic theory of E. V. Appleton and the generalized magnetoionic theory of H. K. Sen and A. A. Wyler. The second method uses only the classical theory of E. V. Appleton. The electron concentration height profiles obtained by the use of the two methods are then compared. 18 refs.

DESCRIPTORS: *IONOSPHERE,

IDENTIFIERS: EXPLOSIONS, Nuclear

CARD ALERT: 443, 481, 622, 657

INVERSE SCATTERING INVESTIGATION

Michigan Univ Ann Arbor Dept of Electrical Engineering (401548)

Quarterly rept. no. 2, 3 Apr-3 Jul 67

AUTHOR: Weston, Vaughan H.; LaRue, John H.

4221E2 Fld: 20N USGRDR6805

Jul 67 38p

Rept No: 8579-2-Q

Contract: F19628-67-C-0190

Monitor: ESD-TR-67-517-Vol-2

Abstract: The problem in question consists of determining means of solving the inverse scattering problem where the transmitted field is given and the received fields are measured, and this data is used to discover the nature of the target. The problem of what information can be determined about the body if the scattering matrix (phase and amplitude) is known only over an angular sector and measured in the far field, is studied further. Asymptotic analysis is used to show that in the high frequency case, portions of a piecewise smooth, convex surface can be found when knowledge of the bistatic scattered field is confined to a small cone. (Author)

Descriptors: (*Electromagnetic waves, Scattering), Electromagnetism, Electromagnetic fields, Numerical analysis

Identifiers: Inverse scattering

AD-663 450 CFSTI Prices: PC A03/MF A01

SOME REMARKS CONCERNING A PATHOLOGICAL MATRIX OF INTEREST IN THE INVERSE-SCATTERING PROBLEM

Defense Research Corp Santa Barbara Calif (000000)

Revised ed

AUTHOR: Redmond, Peter J.

1725C4 USGRDR6509

30 Jun 64 2p

Contract: DA31 124 ARO094

Monitor: AROD-4157-2

Pub. in Journal of Mathematical Physics (U. S.) v5 n11 p1547-54 Nov 1964 (Copies not available to DDC or Clearinghouse customers).

Abstract: A Hermitian matrix which occurs in the theory of the quantum-mechanical inverse-scattering problem has apparently contradictory properties. It has a wellbehaved inverse in spite of having zero as one of its eigenvalues. The properties of the matrix are investigated and the relevance of the results to the theory are discussed. (Author)

Descriptors: (*MATRIX ALGEBRA, QUANTUM MECHANICS), (*QUANTUM MECHANICS, SCATTERING), PHASE SHIFT, VECTOR ANALYSIS, SERIES

Identifiers: INVERSE SCATTERING

AD-612 527

INVERSE SCATTERING INVESTIGATION

Michigan Univ Ann Arbor Radiation Lab (294200)

Quarterly rept. no. 3, 3 Jul-3 Oct 67
AUTHOR: Weston, Vaughan H.; Boerner, Wolfgang M.; Dolph, Charles L.
4382K4 Fld: 20N USGRDR6808
Nov 67 87p
Rept No: 8579-3-Q
Contract: F19628-67-C-0190
Monitor: ESD-TR-67-517-Vol-3
See also quarterly report no. 2, AD-663 450.

Abstract: The problem in question consists of determining means of solving the inverse scattering problem where the transmitted field is given and the received fields are measured, and this data is used to discover the nature of the target. Particular aspects of this overall problem are considered, such as the effect of phase errors upon the determination of the scattering surface, polynomial interpolation of the scattered field measured at a set of discrete points, and the testing of a numerical procedure for finding the surface of a conducting body from the knowledge of the near field. In addition, a review of exact theoretical treatments for the scalar inverse problem is given. (Author)

Descriptors: (*Electromagnetic waves, Scattering), Diffraction, Propagation, Mathematical analysis

Identifiers: Inverse scattering, Far field, Near field

AD-665 857 CFSTI Prices: PC A05/MF A01

THE GENERALIZED POLARIZATION SCATTERING MATRIX

Syracuse Univ Research Corp N Y Special Projects Lab (339854)
AUTHOR: Bojarski, Norbert N.
A0895E2 Fld: 20N, 17I, 80M, 63H USGRDR7021
Dec 68 20p
Rept No: SPL-TR-68-71
Contract: F30602-68-C-0260

Abstract: The conventional definition of the monostatic monocromatic polarization matrix is first extended to the bistatic case, then to the short pulse case, and finally to the bistatic short pulse case. The transformations and convolutions involved are discussed in some detail. The method of determining the Least Square Best Estimate of the Generalized Polarization matrix from a set of measurements is then developed. It is shown that the Faraday rotation angles introduced by a magneto ionic medium intervening the radar and the target are determinable from measured short pulse monostatic polarization matrix data. It is then shown that the Least Square Best Estimate of the orientation angle of a symmetric target is also determinable from Faraday rotation contaminated short pulse monostatic polarization matrix data. (Author)

Descriptors: (*Electromagnetic fields, Scattering), (*Radar pulses, Polarization), (*Radar targets, Range finding), Matrix algebra, Monostatic radar, Bistatic radar, Least squares method, Magneto-optic effect

Identifiers: Inverse scattering, Faraday effect

AD-711 645 CFSTI Prices: HC A02/MF A01

043957 ID NO.- EI7OX143957
Continuous and discrete inverse- scattering problems in a stratified elastic medium- 1
WARE JA; AKI K
Massachusetts Inst of Tech, Cambridge
Acoustical Soc America-J v 45 n 4 Apr 1969 p 911-21
Analytic solution and practical computational procedures for recovering properties of unknown elastic medium from waves reflected or transmitted through medium consisting of two homogeneous half- spaces in contact with heterogeneous region; results used to solve continuous inverse- scattering problem for stratified elastic half- space bounded by free surface. 43956 EI 70 SOUND Lenses Wave analysis of a Luneberg- Gutman fluid acoustic lens; G. LORD (Univ of Washington, Seattle); Acoustical Soc America- J v 45 n 4 Apr 1969 p 885- 91; Wave solution for acoustic fields inside class of perfectly focusing spherical lenses described by Luneberg- Gutman; computation of radial functions; axial and polar patterns for various lenses for wavenumber- aperture products up to 240.
DESCRIPTORS: (*SOUND, *Scattering), LENSES,
IDENTIFIERS: ACOUSTIC LENSES
CARD ALERT: 751

069147 A6943812
AN INVERSE SCATTERING TECHNIQUE FOR ELECTROMAGNETIC BISTATIC SCATTERING
WESTON, V.H.; BOERNER, W.M.
UNIV. MICHIGAN, ANN ARBOR, USA
CANAD. J. PHYS. VOL.47, NO.11 1177-84 1 JUNE 1969
O2
IT IS SHOWN THAT THE TOTAL FIELD PRODUCED BY A PLANE WAVE INCIDENT UPON A SCATTERING BODY CAN BE EXPRESSED AT ALL POINTS IN SPACE AS THE SUM OF THE INCIDENT FIELD AND THE FOURIER TRANSFORM OF A QUANTITY WHICH IS RELATED TO THE SCATTERING MATRIX. FOR POINTS EXTERIOR TO THE MINIMUM CONVEX SURFACE ENCLOSING THE BODY, THE SCATTERED FIELD IS REDUCIBLE TO A PLANE-WAVE REPRESENTATION WHICH REQUIRES KNOWLEDGE OF THE BISTATIC SCATTERED FIELD, FOR A FIXED FREQUENCY AND DIRECTION OF INIDENCE
Descriptors: SCATT., E.M. WAVES
Section Class Codes: A0510

996560 A77002555
FORMAL SOLUTIONS OF INVERSE SCATTERING PROBLEMS. II
PROSSER, R.T.
DEPT. OF MATH., DARTMOUTH COLL., HANOVER, NH, USA
J. MATH. PHYS., NEW YORK (USA) VOL.17, NO.10 1775-9
OCT. 1976 Coden: JMAPAQ
Treatment: T
O2
FOR PT.I SEE IBID., VOL.10, P.1819 (1969). THE WORK OF A PREVIOUS PAPER, IN WHICH FORMAL SOLUTIONS OF CERTAIN INVERSE SCATTERING PROBLEMS WERE DEVELOPED, IS CONTINUED TO SHOW THAT THE SOLUTIONS DO IN FACT CONVERGE IN CERTAIN CASES OF POTENTIAL SCATTERING FOR SUFFICIENTLY WEAK POTENTIALS (7 Refs)
Descriptors: QUANTUM THEORY; POTENTIAL SCATTERING; ACOUSTIC WAVE SCATTERING
Identifiers: INVERSE SCATTERING; POTENTIAL SCATTERING; WEAK POTENTIALS; SOLUTION CONVERGENCE; QUANTUM SCATTERING; ACOUSTIC WAVE SCATTERING
Section Class Codes: A0365N, A4320

182379 ID NO.- EI71X182379
Computational reconstruction of scattering objects from holograms
CARTER WH
Univ of Rachester, NY
J Opt Soc Amer v 60 n 3 Mar 1970 p 306-14 CODEN: JOSAA
Structural details are computed for a fimple transparent object through holographic measurement of scattered monochromatic light. The complex disturbance of the scattered light is measured in amplitude and phase, along a line transverse to the illumination in the Fresnel zone of the object. The scattering potential of the object is then calculated along a parallel line using the field data and a new inverse scattering theory. Data are given for several scattering objects.

114076 ID NO.- EI71X014076
Two- dimensional inverse scattering problem
IMBRIALE WA; MITTRA R
TRW Systems Group, Redondo Beach, Calif
IEEE Trans Anennas Propagat v AP-18 n 5 Sept 1970 p 633-42
It is demonstrated that the knowledge of the incident field and the scattered far fields at one frequency may be employed to determine the size, shape, and location of a perfectly conducting scatterer. The reconstruction of the scattering body is accomplished via an analytic continuation procedure that generates the fields in the neighborhood of the scatter from the specified far- field distribution. The geometry of the body is then determined by locating a closed surface for which the total tangential electric field, i. e. , the sum of the tangential components of the incident and scattered field, is zero, Whereas exact knowledge of the entire far field is sufficient to determine the scatterer, a technique is also given for size and shape determination when only part of the far field is available.
DESCRIPTORS: (*ELECTROMAGNETIC WAVES, *Scattering),
CARD ALERT: 701, 711

251975 A7129441, B7115630
INVESTIGATION OF A CLASS OF ELECTROMAGNETIC BOUNDARY VALUE PROBLEMS (FINAL REPT. FEB. 69-31 JAN 70)
MITTRA, R.
Issued by: ILLINOIS UNIV., URBANA, ILL., USA;
FEB. 1970
18
Availability: CFSTI, SPRINGFIELD, VA. 22151, USA
Treatment: T
11
Report No.: UIAL-70-4
USGRDR No.: AD-707845
Contract No.: F19628-69-C-0015
APPLIES A CLASS OF NEWLY DEVELOPED TECHNIQUES TO THE SOLUTION OF PROBLEMS INVOLVING WAVEGUIDE DISCONTINUITIES, SCATTERING, AND DIFFRACTION AS WELL AS INVERSE SCATTERING PROBLEMS. ANOTHER OBJECTIVE WAS TO STUDY IMAGE PROCESSING AND INVERSE SCATTERING TECHNIQUES INVOLVING COHERENT FIELDS. A RATHER LARGE NUMBER OF WAVEGUIDE AS WELL AS OPEN-REGION BOUNDARY VALUE PROBLEMS HAS BEEN INVESTIGATED USING THE MODIFIED RESIDUE CALCULUS TECHNIQUE AND EXTENDED VERSIONS OF THE SAME. THE RELATIVE ADVANTAGES OF THESE METHODS OVER CONVENTIONAL NUMERICAL METHODS HAVE BEEN DEMONSTRATED. INVESTIGATION OF THE INVERSE SCATTERING PROBLEM BETWEEN PARALLEL PLANES HAS BEEN COMPLETED. THE INVERSE SCATTERING APPROACH HAS BEEN EXTENDED TO SOLVE THE PROBLEM OF SCATTERING FROM CYLINDERS OF ARBITRARY CROSS SECTION
Descriptors: ELECTROMAGNETIC WAVE PROPAGATION; ELECTROMAGNETIC WAVE PROPAGATION GUIDED WAVES; SCATTERING ELECTROMAGNETIC WAVES; GUIDED ELECTROMAGNETIC WAVE PROPAGATION; ELECTROMAGNETIC WAVE SCATTERING
Identifiers: ELECTROMAGNETIC WAVES; BOUNDARY VALUE PROBLEMS; WAVEGUIDE DISCONTINUITIES; SCATTERING; DIFFRACTION; IMAGE PROCESSING; INVERSE SCATTERING TECHNIQUE; COHERENT FIELDS; MODIFIED RESIDUE CALCULUS; NUMERICAL ANALYSIS; HOLOGRAPHY
Section Class Codes: A0510, B2130

K-Space Formulation of the Electromagnetic Scattering Problem

Bojarski (Norbert n) Moorestown N J (389 425)

Final rept. 1 Dec 69-31 May 70
AUTHOR: Bojarski, Norbert N.
C7273E4 Fld: 20N, 17I d7622
Mar 71 216p
Contract: F33615-70-C-1345
Project: AF-5546
Monitor: AFAL-TR-71-75
Distribution limitation now removed.

Abstract: The Electromagnetic Scattering problem is solved by means of a k-space formulation of the Electromagnetic Field equations, thereby replacing the conventional integral equation formulation of the scattering problem by a set of two algebraic equations in two unknowns in two spaces (the constitutive equation being an algebraic equation in x-space). These equations are solved by an iterative method executed with the aid of Fast Fourier Transform (FFT) algorithm connecting the two spaces, requiring very simple zero order initial approximations. Since algebraic and FFT equations are used, the number of arithmetic multiply-add operations and storage allocations required for a numerical solution is reduced from the order of N squared (for solving the matrix equations resulting from the conventional integral equations) to the order of N log(sub 2)N (where N is the number of data points required for the specification of the scatterer). The advantage gained in speed and storage is thus of the order of N/log(sub 2)N and N respectively. This method is thus considerably more efficient, and permits exact numerical solutions for much larger scatterers, than possible with the conventional matrix method. (Author)

Descriptors: (*Electromagnetic radiation, Scattering), Electromagnetic fields, Integral transforms, Integral equations, Partial differential equations, Matrices(Mathematics), Iterations, Numerical analysis, Radar cross sections

Identifiers: *Electromagnetic scattering, Fourier transformation, Fredholm equations, NTISDODXD

AD-882 040/9ST NTIS Prices: PC A10/MF A01

114076 ID NO.- EI71X014076
Two- dimensional inverse scattering problem
IMBRIALE WA; MITTRA R
TRW Systems Group, Redondo Beach, Calif
IEEE Trans Anennas Propagat v AP-18 n 5 Sept 1970 p 633-42
It is demonstrated that the knowledge of the incident field and the scattered far fields at one frequency may be employed to determine the size, shape, and location of a perfectly conducting scatterer. The reconstruction of the scattering body is accomplished via an analytic continuation procedure that generates the fields in the neighborhood of the scatter from the specified far- field distribution. The geometry of the body is then determined by locating a closed surface for which the total tangential electric field, i. e. , the sum of the tangential components of the incident and scattered field, is zero. Whereas exact knowledge of the entire far field is sufficient to determine the scatterer, a technique is also given for size and shape determination when only part of the far field is available.
DESCRIPTORS: (*ELECTROMAGNETIC WAVES, *Scattering),
CARD ALERT: 701, 711

Plasma Inverse Scattering Theory

California Inst of Tech Pasadena Antenna Lab (030750)

Technical rept.
AUTHOR: Balanis, George N.
A3842J1 Fld: 20I, 4A, 55A, 80K GRAI7208
Dec 71 137p
Rept No: TR-62
Grant: AF-AFOSR-1935-70
Project: AF-9768
Task: 976802
Monitor: AFOSR-TR-72-0184

Abstract: The object of the report is to calculate the electron density profile of plane stratified inhomogeneous plasmas. The electron density profile is obtained through a numerical solution of the inverse scattering algorithm. The inverse scattering algorithm connects the time dependent reflected field resulting from a delta-function field incident normally on the plasma to the inhomogeneous plasma density. Examples show that the method produces uniquely the electron density on or behind maxima of the plasma frequency. It is shown that the delta-function incident field used in the inverse scattering algorithm can be replaced by a thin square pulse. (Author)

Descriptors: (*Plasma medium, Electromagnetic waves), (*Ionosphere, *Electron density), (*Electromagnetic waves, Scattering), Partial differential equations, Wave functions, Dielectrics, Integral equations, Curve fitting, Graphics, Numerical analysis, Ionospheric propagation, Theses

Identifiers: *Inverse scattering, Maxwells equations, Fourier transformation

AD-737 518 NTIS Prices: PC A07/MF A01

362361 A7214323, B7210366
PROPERTIES OF ELECTROMAGNETIC PULSE SCATTERING FROM A GROUNDED DIELECTRIC SLAB AT POLARIZING INCIDENCE
BOERNER, W.M.; ANTAR, Y.M.
UNIV. MANITOBA, WINNIPEG, CANADA
INST. ELECTRONICS AND COMMUNICATION ENGRS. JAPAN
1971 INTERNATIONAL SYMPOSIUM ON ANTENNAS AND PROPAGATION. SUMMARIES OF PAPERS 201-2 1971
1-3 SEP 1971 SENDAI, JAPAN
Publ: INST. ELECTRONICS AND COMMUNICATION ENGRS. JAPAN TOKYO, JAPAN
?76
Treatment: T
06
THE INVERSE PROBLEM OF SCATTERING OF AN IDEALIZED ELECTROMAGNETIC SQUARE PULSE FROM A LOSSY DIELECTRIC SLAB MOUNTED ON A PERFECTLY CONDUCTING PLANAR SURFACE IS INVESTIGATED. THE SOLUTION TO THE PROBLEM IS FACILITATED BY A LAPLACE TRANSFORM APPROACH. THE REFLECTION COEFFICIENT IS DETERMINED SEPARATELY FOR THE TE AND THE TM CASES. THE CLOSED FORM SOLUTION OF THE INVERSE LAPLACE TRANSFORM OF THE CONTINUOUS WAVE PARTIAL REFLECTION EXPANSION IS PRESENTED FOR THE GENERAL LOSSLESS CASE OF OBLIQUE INCIDENCE. THE RESULTS INDICATE THAT THE MERITS OF A NON-STEADY STATE INVERSE SCATTERING APPROACH ARE RESTRICTED TO THE SLIGHTLY LOSSY CASE (3 Refs)
Descriptors: SCATTERING, ELECTROMAGNETIC WAVES; ELECTROMAGNETIC WAVE SCATTERING
Identifiers: ELECTROMAGNETIC PULSE SCATTERING; GROUNDED DIELECTRIC SLAB; POLARIZING INCIDENCE; LAPLACE TRANSFORM; REFLECTION COEFFICIENT; LOSSLESS CASE OF OBLIQUE INCIDENCE; SLIGHTLY LOSSY CASE
Section Class Codes: A0510, B2130

393752 A7234257, B7220294
ELECTROMAGNETIC INVERSE SCATTERING
BOJARSKI, N.N.
DEPT. DEFENSE, MOORESTOWN, N.J., USA
IEEE
1971 IEEE GROUP ON ANTENNAS AND PROPAGATION INTERNATIONAL SYMPOSIUM 356-8 1971
22-24 SEP 1971 LOS ANGELES, CALIF., USA
Publ: IEEE NEW YORK, USA
XXXIV+371
Treatment: T
06
AN ELECTROMAGNETIC INVERSE SCATTERING IDENTIY, BASED ON THE PHYSICAL OPTICS APPROXIMATION, IS DEVELOPED FOR THE MONOSTATIC SCATTERED FAR FIELD CROSS SECTION OF PERFECT CONDUCTORS. UNIQUENESS OF THIS INVERSE IDENTITY IS PROVED. THIS IDENTITY REQUIRES COMPLETF SCATTERING INFORMATION FOR ALL FREQUENCIES AND ASPECT ANGLES. AN INTEGRAL EQUATION IS DEVELOPED FOR THE ARBITRARY CASE OF INCOMPLETE FREQUENCY AND/OR ASPECT ANGLE SCATTERING INFORMATION. A GENERAL CLOSED FORM SOLUTION TO THIS INTEGRAL EQUATION IS DEVELOPED, WHICH YIELDS THE SHAPE OF THE SCATTERER FROM SUCH INCOMPLETE INFORMATION. A SPECIFIC PRACTICAL RADAR SOLUTION IS PRESENTED. THE RESOLUTION OF THIS SOLUTION IS DEVELOPED; YIELDING SHORT-PULSE TARGET RESOLUTION PARAMETER EQUATIONS. SPECIAL CASES, SUCH AS A PRIORI KNOWLEDGE OF SCATTERER SYMMETRY, ARE TREATED IN SOME DETAIL. THE MERITS OF THIS SOLUTION OVER THE CONVENTIONAL RADAR IMAGING TECHNIQUE ARE DISCUSSED
Descriptors: SCATTERING ELECTROMAGNETIC WAVES; ELECTROMAGNETIC WAVE SCATTERING; RADAR CROSS SECTIONS
Identifiers: ELECTROMAGNETIC INVERSE SCATTERING; PHYSICAL OPTICS APPROXIMATION; PERFECT CONDUCTORS; INTEGRAL EQUATION
Section Class Codes: A0510, B2130, B2710

243245 A7122724, B7113330
INVERSION OF THE TELEGRAPH EQUATION AND THE SYNTHESIS OF NONUNIFORM LINES
GOPINATH, B.; SONDHI, M.M.
BELL TELEPHONE LABS. INC., MURRAY HILL, N.J., USA
PROC. IEEE (USA) VOL.59, NO.3 383-92 MARCH 1971
Coden: IEEPAD
Treatment: T
02
THE SYNTHESIS OF NONUNIFORM LOSSLESS TRANSMISSION LINES, AN IMPORTANT PROBLEM ARISING IN FIELDS SUCH AS WAVEGUIDE DESIGN, ACOUSTICS, ELECTRICAL CIRCUIT DESIGN, AND SCATTERING THEORY, IS DISCUSSED ENTIRELY IN THE TIME DOMAIN. IT IS SHOWN THAT CORRESPONDING TO EVERY (IMPULSE-RESPONSE) FUNCTION SATISFYING CERTAIN REGULARITY CONDITIONS AND THE PASSIVITY CONDITION IS A LOSSLESS LINE WHOSE TAPER IS SIMPLY RELATED TO THE IMPULSE RESPONSE THROUGH AN INTEGRAL EQUATION. THIS CORRESPONDENCE IS

Complete Solution of the Inverse Scattering Problem at Fixed Energy

Indiana Univ Bloomington Dept of Physics (402112)
AUTHOR: Sabatier, Pierre C.
C1243D3 Fld: 7D GRA17316
19 Apr 71 27p
Grant: DA-ARO-D-31-124-72-G21
Project: DA-2-061102-B-11-B
Monitor: AROD-5992:69-P
Prepared in cooperation with Montpellier Univ., (France). Dept. de Physique Mathematique.
Availability: Pub. in Jnl. of Mathematical Physics, v13 n5 p675-699 May 72.

Descriptors: (*Potential scattering, Wave functions), Partial differential equations, Phase shift, Matrix algebra, Elastic scattering

Identifiers: Schrodinger equation, Inverse problems, A

AD-702 956 NTIS Price: Reprint

297105 A7159981
NUMERICAL COMPUTATIONS IN THE INVERSE-SCATTERING PROBLEM AT FIXED ENERGY
SABATIER, P.C.; QUYEN VAN PHU, F.
UNIV. MONTPELLIER, FRANCE
PHYS. REV. D (USA) VOL.4, NO.1 127-32 1 JULY 1971
Coden: PRVDAQ
Treatment: T
02
CONSTRUCTING POTENTIALS FROM THE PHASE SHIFTS AT A GIVEN ENERGY YIELDS AN INFINITY OF EQUIVALENT SOLUTIONS. THE DEVIATIONS OF THESE SOLUTIONS FROM EACH OTHER CAN, HOWEVER, BE ANALYZED ACCORDING TO A PRIORI LIMITATIONS ON THE DERIVATIVES AND OTHER FEATURES OF 'ACCEPTABLE' POTENTIALS. A SKETCH OF THIS ANALYSIS IS GIVEN TOGETHER WITH A NUMERICAL COMPARISON OF USUAL POTENTIAL FORMS WITH THE EQUIVALENT POTENTIALS OBTAINED THROUGH NEWTON'S METHOD. THE OBSERVED DEVIATION GIVES AN APPRAISAL OF THE DEVIATIONS FROM EACH OTHER OF ALL THE EQUIVALENT POTENTIALS WITH SIMILAR BOUNDS ON THE DERIVATIVES. THE DEVIATION IS SMALL WHEN THERE ARE MANY PHASE SHIFTS AVAILABLE, ALL OF THEM DEFINITELY SMALLER THAN PI/2. FOR A STATIC POTENTIAL THESE CONDITIONS CAN BE MET FOR HIGH ENERGIES
Descriptors: SCATTERING
Identifiers: POTENTIAL CONSTRUCTION; INVERSE SCATTERING; FIXED ENERGY; PHASE SHIFTS; NEWTON'S METHOD
Section Class Codes: A0220

302314 A7163390
A COHERENT-OPTICAL APPROACH TO THE INVERSE SCATTERING PROBLEM
SCHMIDT-WEINMAR, H.G.
UNIV. ALBERTA, EDMONTON, CANADA
CANADIAN ASSOC. PHYSICISTS
PHYS. CAN. (CANADA) VOL.27, NO.4 65 1971
CANADIAN ASSOCIATION OF PHYSICISTS' ANNUAL CONGRESS 21-24 JUNE 1971 OTTAWA, ONTARIO, CANADA
Treatment: T
06
USING A SEQUENCE OF THREE COHERENT OPTICAL REFERENCE FIELDS, MAGNITUDE AND PHASE OF SCATTERED LIGHT CAN BE DETERMINED FROM THE FAR-FIELD INTENSITY MEASURED AT VARIOUS SCATTERING ANGLES. THE RESULTS OF COMPUTER-SIMULATIONS OF A SCATTERING EXPERIMENT BASED UPON THIS PRINCIPLE ARE DISCUSSED. THE INVERSE COMPLEX SCATTERING MATRIX IS GIVEN FOR THE CASE OF A SEMI-TRANSPARENT, WEAKLY AND COHERENTLY SCATTERING THREE-DIMENSIONAL SYSTEM THAT CAN BE REPRESENTED BY A FINITE NUMBER OF SAMPLES OF THE COMPLEX SCATTERING POTENTIAL
Descriptors: SCATTERING LIGHT
Identifiers: FAR FIELD INTENSITY; COMPUTER SIMULATION; INVERSE SCATTERING PROBLEM; COHERENT OPTICAL REFERENCE FIELDS; MAGNITUDE; PHASE; SCATTERED LIGHT; INVERSE COMPLEX SCATTERING MATRIX; COMPLEX SCATTERING POTENTIAL
Section Class Codes: A0820

362340 A7217477, B7210342
ASPECTS OF ELECTROMAGNETIC PULSE SCATTERING FROM A GROUNDED DIELECTRIC SLAB
BOERNER, W.M.; ANTAR, Y.M.
ARCH. ELEKTRON. AND UBERTRAGUNGSTECH. (GERMANY) VOL.26, NO.1 14-21 JAN. 1972
Treatment: T
02
Languages: ENGLISH
THE PROBLEM OF SCATTERING OF AN IDEALIZED ELECTROMAGNETIC SQUARE PULSE FROM A LOSSY DIELECTRIC SLAB MOUNTED ON A PERFECTLY CONDUCTING PLANAR SURFACE IS INVESTIGATED. FIRST THE LOSSLESS CASE IS TREATED IN DETAIL AND ALL THE REQUIRED FORMULATIONS ARE DERIVED. PARTICULAR EMPHASIS IS GIVEN TO THE STUDY OF INTERNALLY REFLECTED AND REFRACTED PULSE RETURNS FROM THE GROUNDED SLAB AT BREWSTER ANGLE CONDITIONS. IT IS FOUND THAT THE DECOMPOSITION OF THE INITIALLY INCIDENT SINGLE PULSE INTO A SEQUENCE OF DELAYED PULSES REDUCES, AT BREWSTER ANGLE CONDITIONS, TO ONLY ONE SINGLE PULSE RETURN WHICH IS PHASE DELAYED. THE ANALYSIS IS THEN EXTENDED TO THE LOSSY CASE,

PROVING THAT FOR SLIGHTLY LOSSY MATERIALS THE SAME ANOMALOUS BEHAVIOUR IS ENCOUNTERED. A NOVEL SUITABLE MEASUREMENT TECHNIQUE IS PROPOSED AND PRESENTLY IS INVESTIGATED EMPLOYING A LASER SETUP (19 Refs)

Descriptors: SCATTERING/ELECTROMAGNETIC WAVES; DIELECTRIC PHENOMENA; ELECTROMAGNETIC WAVE SCATTERING; DIELECTRIC PROPERTIES

Identifiers: SCATTERING; ELECTROMAGNETIC SQUARE PULSE; LOSSY DIELECTRIC SLAB; GROUNDED SLAB; BREWSTER ANGLE; MEASUREMENT TECHNIQUE; LASER SETUP

Section Class Codes: A0510, B2130

472140 A7305723

K-SPACE FORMULATION OF THE ACOUSTIC SCATTERING PROBLEM

BOJARSKI, N.N.

DEPT. DEFENSE, MOORESTOWN, N.J., USA

LINDSAY, R.B. (Editors)

1972

PROGRAM OF THE 84TH MEETING OF THE ACOUSTICAL SOCIETY OF AMERICA. (ABSTRACTS ONLY) 102 1972

28 NOV. - 1 DEC. 1972 MIAMI BEACH, FLA., USA

Publ: ACOUST. SOC. AMERICA NEW YORK, USA

120 PP

Treatment: T

06

THE ACOUSTIC SCATTERING PROBLEM IS SOLVED BY MEANS OF A K-SPACE FORMULATION OF THE FIELD EQUATIONS, THEREBY REPLACING THE CONVENTIONAL INTEGRAL EQUATION FORMULATION BY A SET OF TWO SIMULTANEOUS ALGEBRAIC EQUATIONS IN TWO UNKNOWNS IN TWO SPACES (THE CONSTITUTIVE BOUNDARY CONDITION BEING AN ALGEBRAIC EQUATION IN X SPACE). THESE EQUATIONS ARE SOLVED BY AN ITERATIVE METHOD WITH THE AID OF THE FAST FOURIER TRANSFORM (FFT) ALGORITHM CONNECTING THE TWO SPACES, REQUIRING TRIVIAL INITIAL APPROXIMATIONS. SINCE ALGEBRAIC AND FFT EQUATIONS ARE USED, THE NUMBER OF ARITHMETIC MULTIPLY-ADD OPERATIONS AND STORAGE ALLOCATIONS REQUIRED FOR A NUMERICAL SOLUTION ARE REDUCED FROM THE ORDER OF N/SUP 3/ AND N/SUP 2/, RESPECTIVELY (FOR SOLVING THE MATRIX EQUATIONS RESULTING FROM THE CONVENTIONAL INTEGRAL EQUATIONS), TO THE ORDER OF N LOG/SUB 2/N AND N, RESPECTIVELY (WHERE N IS THE NUMBER OF DATA POINTS REQUIRED FOR THE SPECIFICATION OF THE PROBLEM). THE ADVANTAGE GAINED IN SPEED AND STORAGE IS THUS OF THE ORDER OF N/SUP 2//LOG/SUB 2/N AND N, RESPECTIVELY. THIS METHOD IS THUS CONSIDERABLY MORE EFFICIENT, AND PERMITS EXACT NUMERICAL SOLUTIONS FOR MUCH LARGER PROBLEMS THAN POSSIBLE WITH THE CONVENTIONAL INTEGRAL EQUATION-MATRIX INVERSION METHOD. THE DETAILS AND SOME NUMERICAL RESULTS OF THE APPLICATION OF THIS METHOD TO TWO- AND THREE-DIMENSIONAL ACOUSTIC SCATTERING ARE PRESENTED

Descriptors: ACOUSTIC WAVE SCATTERING

Identifiers: ACOUSTIC SCATTERING; FAST FOURIER TRANSFORM; K-SPACE FORMULATION

Section Class Codes: A9820

Unified Class Codes: ZCCAAN

288899 ID NO.- EI721210900

ANTENNA SYNTHESIS AND SOLUTION OF INVERSE PROBLEMS BY REGULARIZATION METHODS.

Deschamps, Georges A.; Cabayan, Hrair S.

Univ of Illinois, Urbana

IEEE Trans Antennas Propag v AP-20 n 3 May 1972 p 268-274

CODEN: IETPAK

Antenna pattern synthesis is discussed as an example of $left double quote$ improperly posed $right double quote$ problems. This serves the purpose of introducing a concept that is useful in many other applications: remote sensing, inverse scattering, etc. It also suggests that regulation methods that have been devised to $left double quote$ solve $right double quote$ improperly posed problems can be applied to antenna synthesis and the aforementioned problems. This gives systematic methods for solving the pattern synthesis problem even when the element patterns are arbitrary. 10 refs.

DESCRIPTORS: (*ANTENNAS, *Radiation),

IDENTIFIERS: ANTENNA PATTERN SYNTHESIS, REGULARIZATION METHODS

CARD ALERT: 716

398214 A7241520
COMPLETE SOLUTION OF THE INVERSE SCATTERING PROBLEM AT FIXED ENERGY
SABATIER, P.C.
UNIV. MONTPELLIER, FRANCE
J. MATH. PHYS., NEW YORK (USA) VOL.13, NO.5 675-99 MAY 1972 Coden: JMAPAQ
Treatment: T
02
LED D BE THE CLASS OF FUNCTIONS WHICH ARE BOUNDED BY CR/SUP -1+EPSILON/ AND CR/SUP -3-EPSILON/, E THE CLASS OF POTENTIALS V(R) SUCH THAT V(R), RV MINUTES (R), AND R/SUP 2/ VSECONDS (R) BELONG TO D. E IS DENSE IN THE CLASS OF POTENTIALS V WITH FINITE NORM INTEGRAL/SUB O//SUP INFINITY/RHO#V(RHO)#DRHO IN WHICH ALMOST ALL THE RESULTS OF POTENTIAL SCATTERING ARE DERIVED. IN THIS PAPER A COMPLETE SOLUTION OF THE INVERSE SCATTERING PROBLEM AT FIXED ENERGY IS GIVEN IN A CLASS E/SUP */ OF POTENTIALS WHICH CONTAINS E. THIS MEANS THAT GIVEN ANY SET OF PHASE SHIFTS BOUNDED BY CL/SUP -1-EPSILON/, THE AUTHOR CONSTRUCTS ALL THE POTENTIALS OF E/SUP */ WHICH FIT THIS SET OF PHASE SHIFTS. THEY DEPEND ON AN ARBITRARY FUNCTION. THE FUNDAMENTAL TOOL IN THE SOLUTION IS THE 'SCATTERING STRUCTURE FUNCTION'. THE METHOD IS DERIVED IN SUCH A WAY THAT AN APPROXIMATION THEORY AND NUMERICAL COMPUTATIONS ARE FEASIBLE. THESE, TOGETHER WITH VARIOUS STUDIES OF THE SOLUTIONS, ARE THE OBJECT OF FORTHCOMING PAPERS (51 Refs)
Descriptors: SCATTERING; QUANTUM THEORY WAVE EQUATION
Identifiers: INVERSE SCATTERING PROBLEM; FIXED ENERGY; CLASS OF FUNCTIONS; CLASS OF POTENTIALS; PHASE SHIFTS; SCATTERING STRUCTURE FUNCTION; APPROXIMATION THEORY; SCHROEDINGER EQUATION
Section Class Codes: A0220

402621 A7246761
TEMPERATURE PROFILE DETERMINATION IN AN ABSORBING PLASMA
USHER, J.L.; CAMPBELL, H.O.
UNIV. FLORIDA, GAINESVILLE, USA
J. QUANT. SPECTROSC. AND RADIAT. TRANSFER (GB) VOL. 12 NO. 7 1157-60 JULY 1972 Coden: JQSRAE
Treatment: TX
02
A NEW METHOD HAS BEEN DEVELOPED TO DETERMINE THE TEMPERATURE PROFILE OF AN OPTICALLY-NON-THIN PLASMA. THE TECHNIQUE IS ESSENTIALLY AN EXTENSION OF THE BRIGHTNESS-EMISSIVITY METHOD TO THE CASE OF A CYLINDRICALLY-SYMMETRIC PLASMA (7 Refs)
Descriptors: PLASMA DIAGNOSTIC; TEMPERATURE MEASUREMENT
Identifiers: OPTICALLY NON THIN PLASMA; BRIGHTNESS EMISSIVITY METHOD; TEMPERATURE PROFILE DETERMINATION; ABSORBING PLASMA
Section Class Codes: A1424

523732 A7339524
INDIRECT VERTICAL PROFILE DETERMINATION OF THE ATMOSPHERIC MOISTURE CONTENT
BOGOMOLOV, O.S.; PANIN, B.D.
IZV. AKAD. NAUK SSSR FIZ. ATMOS. AND OKEANA VOL.9, NO.4 363-70 APRIL 1973 Coden: IFAOAV
Trans In: BULL. ACAD. SCI. USSR. ATMOS. AND OCEANIC PHYS. SER. (USA) VOL.9, NO.4 Coden: BSUAAZ
Treatment: T
02
Languages: RUSSIAN
AN ITERATION SCHEME OF THE VERTICAL PROFILE DETERMINATION OF MOISTURE CONTENT BY THE REGULARIZATION METHOD IS CONSIDERED USING THE SPECTRAL COMPOSITION DATA OF THE OUTGOING RADIATION IN THE 6.3 MU WATER-VAPOUR ABSORPTION BAND. AS THE INITIAL DATA THE CALCULATED VALUES OF THE OUTGOING RADIATION ARE USED. SOME EXAMPLES AND ACCURACY ESTIMATIONS ARE PRESENTED (11 Refs)
Descriptors: ATMOSPHERIC HUMIDITY; MOISTURE; ATMOSPHERIC SPECTRA
Identifiers: INDIRECT VERTICAL PROFILE DETERMINATION; ATMOSPHERIC MOISTURE CONTENT; SPECTRAL COMPOSITION DATA; 6.3 MICRON H/SUB 2/O VAPOUR ABSORPTION BAND
Section Class Codes: A9340
Unified Class Codes: ZKKACE

649966 A7439685, B7423634

ELECTROMAGNETIC INVERSE BOUNDARY CONDITIONS

BOERNER, W.M.; AHLUWALIA, H.P.S.
UNIV. MANITOBA, WINNIPEG, CANADA

PHYS. CAN. (CANADA) VOL.29, NO.24 33 1973
CANADIAN ASSOCIATION OF PHYSICISTS 1973 CONGRESS. (ABSTRACTS ONLY) 18-21 JUNE 1973 MONTREAL, CANADA
Treatment: T
O6

AN EXACT PROBLEM OF E.M. INVERSE SCATTERING IS CONSIDERED FOR WHICH THE TARGET CHARACTERISTICS OF UNKNOWN SCATTERERS NEED TO BE DETERMINED. IT IS ASSUMED THAT THE INCIDENT AND THE SCATTERED FIELDS ARE GIVEN EVERYWHERE AND THAT THE LAWS OF INTERACTION SATISFY THE LEONTOVICH CONDITION. TO RECOVER THE A PRIORI UNKNOWNS, I.E. THE EXACT SURFACE LOCI OF DISCONTINUITIES IN MATERIAL CONSTITUTIVES AND THEIR EXACT VALUES, THE CONCEPT OF E.M. INVERSE BOUNDARY CONDITIONS IS EMPLOYED. NAMELY, TWO BASIC UNIQUE VECTORS A=EXE*-ZETAZETA*HXH* AND B=ZETAE*XH-ZETA*EXH* CAN BE DERIVED FROM INVERSION OF THE LEONTOVICH CONDITION WHICH LIE IN THE LOCAL SCATTERING PLANE, ARE ORTHOGONAL AND OF IDENTICAL MAGNITUDE, WHERE E AND H DENOTE THE TOTAL ELECTRIC AND MAGNETIC VECTORS, ZETA THE LOCAL AVERAGED SURFACE IMPEDANCE, AND THE QUANTITIES WITH ASTERISKS REPRESENT THE COMPLEX CONJUGATES. THUS TWO INDEPENDENT NECESSARY, NOT LOCALLY BUT GLOBALLY SUFFICIENT CONDITIONS A*B=O AND A/SUP 2/-B/SUP 2/=O EXIST WHICH CAN BE EMPLOYED TO UNIQUELY RECOVER THE CHARACTERISTIC PARAMETERS OF CONDUCTING SHAPES

Descriptors: ELECTROMAGNETIC WAVE SCATTERING; BOUNDARY VALUE PROBLEMS
Identifiers: ELECTROMAGNETIC INVERSE BOUNDARY CONDITIONS; TARGET CHARACTERISTICS; LEONTOVICH CONDITION; LOCAL SCATTERING PLANE; MAGNETIC VECTORS; SURFACE IMPEDANCE; ELECTRIC VECTORS
Section Class Codes: A2246, B3144
Unified Class Codes: ECEEAW

Inverse Scattering

Bojarski (Norbert n) Moorestown N J (389 425)

Final rept.
AUTHOR: Bojarski, Norbert N.
C7352B4 Fld: 17I d7622
Apr 73 106p
Contract: N00019-72-C-0462
Monitor: 18
Distribution limitation now removed.

Abstract: A three-dimensional electromagnetic Inverse Scattering Identity, based on the Physical Optics approximation, is developed for the monostatic scattered far field cross section of perfect conductors. Uniqueness of this inverse scattering identity is proven. This identity requires complete scattering information for all frequencies and aspect angles. A non-singular integral equation is developed for the arbitrary case of incomplete frequency and/or aspect angle scattering information. A general closed form solution to this integral equation is developed, which yields the shape of a scatterer from such incomplete information. A specific practical radar solution is presented. The resolution of this solution is developed, yielding short-pulse target resolution radar system parameter equations. The general inverse scattering and radiation problem associated with the three-dimensional inhomogeneous scalar field Helmholtz wave equation is formulated as a Fredholm integro-differential equation of the second kind. The far-field inverse integro-differential equation is solved in closed form with the aid of a single resolvent integral operator, which can be readily evaluated numerically with the aid of the fast Fourier transform algorithm. The inverse integro-differential equation and its solution are then generalized to the reduced vector wave equation resulting from Maxwell's equations. A formal statement of the inverse problem is presented. It is shown that the first order Neumann series solution of the inverse integro-differential equation as well as the first order term of its exact solution represent the physical optics approximation and the equations governing synthetic microwave holography.

Descriptors: (*Radar images, Scattering), (*Synthetic aperture radar, Radar pulses), Resolution, Integral equations, Differential equations, Electromagnetic properties, Approximation(Mathematics), Problem solving, Radar cross sections, Integral transforms, Algorithms, Computer programs, Spheres, Cylindrical bodies, Mathematical models

Identifiers: Inverse scattering, NTISDODXD

AD-910 661/8ST NTIS Prices: PC A06/MF A01

The Discrete Inverse Scattering Problem in One Dimension

Rockefeller Univ New York Dept of Physics (405310)
AUTHOR: Case, K. M.
C3123C4 Fld: 20J GRAI7417
18 Jun 73 6p
Grant: AF-AFOSR-2187-72
Project: AF-9767
Task: 976702
Monitor: AFOSR-TR-74-0858
Availability: Pub. in Jnl. of Mathematical Physics, v15 n2 p143-146 Feb 74.

Abstract: A discrete version of the inverse scattering problem in one dimension is considered. While the natural formulation is somewhat different from the three-dimensional problem with spherical symmetry, the equations of solution turn out to be almost identical. Indeed, in the continuous limit (Schrodinger equation) even the slight differences disappear. Two equivalent treatments corresponding to considering incidence from left to right are given. For actual computation a combination of the two seems most efficient. (Author)

Descriptors: *Quantum theory, Matrices(Mathematics), Schrodinger equation

Identifiers: *Inverse scattering, NTISDODAF

AD-781 119/3 NTIS Price: Reprint

On Discrete Inverse Scattering Problems. II

Rockefeller Univ New York Dept of Physics (405310)
AUTHOR: Case, Kenneth M.
C2441L3 Fld: 20J GRAI7408
23 Jan 73 6p
Grant: AF-AFOSR-2187-72
Project: AF-9767
Task: 976704
Monitor: AFOSR-TR-74-0165
Availability: Pub. in Jnl. of Mathematical Physics, v14 n7 p916-920 Jul 73.

Abstract: A discrete version of the inverse scattering problem of the Schrodinger equation with a potential is discussed. The approach is via the Marchenko equation. Interest is primarily pedagogical. All steps are elementary and relatively obvious. Passage to the continuous case as a limit is heuristically straightforward. An example shows how the formalism does produce the potential from scattering data. (Author)

Descriptors: *Potential scattering, *Schrodinger equation, Eigenvectors

Identifiers: *Inverse scattering, Eigenvalues, Marchenko equation, AF

AD-774 421/2 NTIS Price: Reprint

ON DISCRETE INVERSE SCATTERING PROBLEMS. II
CASE, K.M.
ROCKEFELLER UNIV., N.Y., USA
J. MATH. PHYS., NEW YORK (USA) VOL.14, NO.7 916-20 JULY 1973 Coden: JMAPAQ
Treatment: T
02
FOR PT. I SEE ABSTR. A35589 OF 1973. THE DISCRETE VERSION OF THE SCHRODINGER POTENTIAL PROBLEM IS FORMULATED, AND THE INVERSE SCATTERING PROBLEM IS SOLVED FORMALLY USING THE MARCHENKO EQUATION. A WORKED EXAMPLE IS GIVEN AND THE CONTINUOUS LIMIT IS FOUND (7 Refs)
Descriptors: QUANTUM THEORY; SCATTERING; SCHRODINGER EQUATION
Identifiers: SCHRODINGER POTENTIAL PROBLEM; MARCHENKO EQUATION; CONTINUOUS LIMIT; DISCRETE INVERSE SCATTERING PROBLEMS
Section Class Codes: A1400
Unified Class Codes: DEAAKY

525289 A7339549, B7324888
TRANSFER FUNCTIONS OF SOME IONOSPHERIC MODELS
CHECCACCI, P.F.; SCHEGGI, A.M.
CONSIGLIO NAZIONALE RICERCHE, FLORENCE, ITALY
IEEE TRANS. ANTENNAS AND PROPAG. (USA) VOL. AP-21, NO.3 400-2 MAY 1973 Coden: IETPAK
Treatment: G
02
THE SPATIAL IMPULSE RESPONSE FUNCTIONS OF SIMPLE IONOSPHERIC MODELS ARE COMPUTED USING A RAY-TRACING TECHNIQUE. SUCH FUNCTIONS SHOW MEASURABLE DEPENDENCE ON THE SINGLE PARAMETERS CHARACTERIZING THE ASSUMED PROFILE. HENCE THE SOLUTION OF THE INVERSE PROBLEM (I.E., TO DETERMINE THE PROFILE OF THE IONOSPHERE FROM A MEASURED IMPULSE RESPONSE FUNCTION) SEEMS FEASIBLE (3 Refs)
Descriptors: IONOSPHERE; TRANSIENT RESPONSE; IONOSPHERIC MEASUREMENTS; MODELLING
Identifiers: SPATIAL IMPULSE RESPONSE FUNCTIONS; IONOSPHERIC MODELS; RAY TRACING; IONOSPHERE PROFILE DETERMINATION
Section Class Codes: A9360, A93R2, B4820
Unified Class Codes: ZKRAAW, ZKVCAE

565315 A7366948
RADIATING AND NONRADIATING CLASSICAL CURRENT DISTRIBUTIONS AND THE FIELDS THEY GENERATE
DEVANEY, A.J.; WOLF, E.
UNIV. ROCHESTER, N.Y., USA

PHYS. REV. D (USA) VOL.8, NO.4 1044-7 15 AUG. 1973 Coden: PRVDAQ
Treatment: T
02
SEVERAL GENERAL THEOREMS ARE ESTABLISHED RELATING TO WELL-BEHAVED, LOCALIZED, MONOCHROMATIC CURRENT DISTRIBUTIONS AND THE FIELDS THAT THEY GENERATE. IN PARTICULAR, A NECESSARY AND SUFFICIENT CONDITION FOR SUCH A CURRENT DISTRIBUTION TO BE NONRADIATING IS ESTABLISHED AND A GENERAL EXPRESSION FOR ALL NONRADIATING CURRENT DISTRIBUTIONS OF THIS CLASS IS OBTAINED (12 Refs)
Descriptors: CURRENT ALGEBRA; ELECTROMAGNETIC FIELD THEORY
Identifiers: CLASSICAL CURRENT DISTRIBUTIONS; FIELDS; GENERAL THEOREMS; NONRADIATING
Section Class Codes: A3140, A3390
Unified Class Codes: GBKACH, GFZAAA

419312 ID NO.- EI740419312
AN APPLICATION OF ONE-DIMENSIONAL INVERSE-SCATTERING THEORY FOR INHOMOGENEOUS REGIONS.
Jordan, A. K.; Kritikos, H. N.
Univ of Pa, Philadelphia
IEEE Trans Antennas Propag v AP-21 n 6 Nov 1973 p 909-911
CODEN: IETPAK
One-dimensional inverse-scattering theory is applied to the study of the reflection of electromagnetic waves from an inhomogeneous region. The exact refractive index profile is obtained that will produce a reflection coefficient in which the frequency dependence is described by the Butterworth approximation. The physical model used may be applied in the study of the scattering of millimeter waves by semiconductor surfaces. 13 refs.
DESCRIPTORS: (*ELECTROMAGNETIC WAVES, *Scattering).
CARD ALERT: 711

605943 A7408764, B7406640, C7405896
INVERSE SCATTERING AND REMOTE PROBING
MITTRA, R.
UNIV. ILLINOIS, URBANA, USA
MITTRA, R. (Editors)
COMPUTER TECHNIQUES FOR ELECTROMAGNETICS 351-97 1973
Publ: PERGAMON OXFORD, ENGLAND
ISBN 0 08 016888 4
Treatment: T
04
THOUGH THERE EXISTS A LARGE BODY OF LITERATURE DEALING WITH THE 'FORWARD' SCATTERING PROBLEM, THE NUMBER OF WORKS DEALING WITH THE INVERSE PROBLEM IS RELATIVELY FEW. THIS IS DUE PRIMARILY TO THE COMPLEXITIES ASSOCIATED WITH THE INVERSE PROBLEM. MANY OF THE INVERSE PROBLEMS DO NOT LEND THEMSELVES TO FORMULATION IN TERMS OF LINEAR MATRIX OR INTEGRAL EQUATIONS, AND CONSEQUENTLY, SOPHISTICATED TECHNIQUES ARE REQUIRED TO RESOLVE THEM. EVEN WHEN IT IS POSSIBLE TO DESCRIBE THE INVERSE PROBLEM IN TERMS OF A LINEAR MATRIX EQUATION, THE RESULTING EQUATION IS OFTEN ILL-CONDITIONED, AND ITS INVERSE UNSTABLE. SPECIAL TECHNIQUES ARE AGAIN NECESSARY TO HANDLE THESE CASES. TO INTRODUCE SOME OF THE COMPUTER TECHNIQUES FOUND USEFUL FOR SOLVING INVERSE PROBLEMS, THE PAPER DISCUSSES FIVE ILLUSTRATIVE PROBLEMS IN THIS CATEGORY (14 Refs)

522400 A7337854
THE THREE-DIMENSIONAL INVERSE SCATTERING PROBLEM FOR THE HELMHOLTZ EQUATION
SLEEMAN, B.D.
UNIV. DUNDEE, SCOTLAND
PROC. CAMB. PHILOS. SOC. (GB) VOL.73, PT.3 477-88 1973
Coden: PCPSA4
Treatment: T
02
THE AUTHOR EXAMINES SOLUTIONS OF THE THREE-DIMENSIONAL

HELMHOLTZ EQUATION WHICH ARE OF CLASS C/SUP 2/ (I.E. REGULAR) IN THE EXTERIOR OF A BOUNDED DOMAIN D. IN CYLINDRICAL POLAR COORDINATES (R,Z,PHI) SUCH SOLUTIONS SATISFY THE EQUATION DELTA/SUP 2/U/DELTAR/SUP 2/+(1/R) DELTAU/DELTAR+(1/R/SUP 2/) DELTA/SUP 2/U/DELTAPHI/SUP 2/+DELTA/SUP 2/U/DELTAZ/SUP 2/+U=0, IN WHICH THE WAVE NUMBER IS NORMALIZED TO UNITY AND U SATISFIES THE SOMMERFELD RADIATION CONDITION LIM/SUB R=INFINITY/R(DELTAU/DELTAR-IU)=O(R=SQROOT(R/SUP 2/+Z/SUP 2/)) (17 Refs)
Descriptors: ELECTROMAGNETIC WAVE SCATTERING; PARTIAL DIFFERENTIAL EQUATIONS
Identifiers: HELMHOLTZ EQUATION; CYLINDRICAL POLAR COORDINATES; SOMMERFELD RADIATION CONDITION; THREE DIMENSIONAL INVERSE SCATTERING PROBLEM
Section Class Codes: A1380
Unified Class Codes: DDKAAK

546338 ID NO.- EI750746338

INVERSE SCATTERING TRANSFORM-FOURIER ANALYSIS FOR NONLINEAR PROBLEMS.

Ablowitz, Mark J.; Kaup, David J.; Newell, Alan C.; Segur, Harvey

Clarkson Coll of Technol, Potsdam, NY

Stud Appl Math v 53 n 4 Dec 1974 p 249-315 CODEN: SAPMB6

A comprehensive presentation of the inverse scattering method is given and general features of the solution are discussed. The relationship of the scattering theory and Backlund transformations is brought out. In view of the role of the dispersion relation, the comparatively simple asymptotic states, and the similarity of the method itself to Fourier transforms, this theory can be considered a natural extension of Fourier analysis to nonlinear problems. 63 refs.

DESCRIPTORS: (*MATHEMATICAL TECHNIQUES, *Nonlinear Equations

826398 A7579143

RECENTLY DEVELOPED FORMULATIONS OF THE INVERSE PROBLEM IN ACOUSTICS AND ELECTROMAGNETICS

BLEISTEIN, N.; BOJARSKI, N.N.

Issued by: DENVER RES. INST., COLO., USA;

DEC. 1974

37

Availability: NTIS, SPRINGFIELD, VA. 22161, USA

Treatment: T

11

Report No.: MS-R-7501

Contract No.: N00014-67-A-0391-0005

THERE ARE TWO TYPES OF FORMULATIONS, ONE IN THE GEOMETRICAL OPTICS LIMIT AND THE OTHER. AN EXACT FORMULATION FOR THE INVERSE SOURCE PROBLEM. BOTH BASIC FORMULATIONS ARE EXTENDED TO INCLUDE THE REALISTIC PROBLEM OF A 'LIMITED APERTURE' OF OBSERVATIONS. IT IS ALSO SHOWN THAT THE INVERSE SOURCE FORMULATION CAN BE APPLIED TO THE PROBLEM OF RECONSTRUCTION OF MEDIA INHOMOGENEITIES FROM REMOTELY SENSED FIELD DATA. THE BASIC PHYSICAL OPTICS RESULT IS THAT THE CHARACTERISTIC FUNCTION OF THE SCATTERING OBSTACLE AND THE PHASE AND RANGE NORMALIZED SCATTERING AMPLITUDE ARE A FOURIER TRANSFORM PAIR. ALL OTHER FORMULATIONS LEAD TO FREDHOLM INTEGRAL EQUATIONS OF THE FIRST KIND

Descriptors: ELECTROMAGNETISM; ACOUSTICS; PHYSICAL OPTICS; ELECTROMAGNETIC WAVE SCATTERING; ACOUSTIC WAVE SCATTERING; GEOMETRICAL OPTICS; ACOUSTIC APPLICATIONS; FOURIER TRANSFORMS

Identifiers: INVERSE PROBLEM; ACOUSTICS; GEOMETRICAL OPTICS; INVERSE SOURCE PROBLEM; MEDIA INHOMOGENEITIES; FREDHOLM INTEGRAL EQUATIONS; ELECTROMAGNETISM; FOURIER TRANSFORM PAIR; OBSERVATIONS LIMITED APERTURE; PHYSICAL OPTICS; SCATTERING OBSTACLE CHARACTERISTIC FUNCTION; NORMALISED SCATTERING

Inverse Scattering

Bojarski (Norbert N.), Moorestown, N.J. (389 425)

Final rept.
AUTHOR: Bojarski, Norbert N.
C2515D1 Fld: 20N GRAI7409
Feb 74 20p
Contract: N00019-73-C-0312
Monitor: 18
See also AD-910 661.

Abstract: The Physical Optics and Exact Inverse Scattering solutions of this author are summarized. For the Physical Optics Inverse Scattering Method, shown are computer-reconstructed images of a sphere and cylinder from computer synthetic scattering data, as well as a sphere from experimentally measured data. For the exact Inverse Scattering Method, shown are computer-reconstructed source distributions (currents) of a half wave dipole antenna, a point-source, and two point-sources separated by one-half-wavelength, from computed synthetic scattering data. (Author)

Descriptors: *Electromagnetic scattering, Dipole antennas, Computer graphics, Integral equations

Identifiers: Inverse scattering, N

AD-775 235/5 NTIS Prices: PC A02/MF A01

413288 ID NO.- EI740313288
RECONSTRUCTION OF INHOMOGENEOUS SCATTERING OBJECTS FROM HOLOGRAMS.
Carter, William H.; Ho, Pin-Chin
US Nav Res Lab, Washington, DC
Appl Opt v 13 n 1 Jan 1974 p 162-172 CODEN: APOPAI
An experiment is reported in which the one-dimensional scattering potential along a line through a semitransparent bar with nonuniform index of refraction is determined from holographic measurements of scattered monochromatic light waves. The experiment is performed using an inhomogeneous bar for the first time in order to test quantitatively a recently developed inverse scattering theory. This theory suggests a method by which the three-dimensional structure of a semitransparent, weakly scattering object can be determined by means of light scattering experiments. The structural data obtained in this experiment agree with known object parameters to within errors of the order of a few percent. In addition, a problem that occurred in earlier experiments concerningthe presence of an unwanted background is analyzed. A method for removing the background is described. 10 refs.
DESCRIPTORS: *HOLOGRAPHY, (LIGHT, Scattering),
CARD ALERT: 741, 743

656833 A7451697
THE DISCRETE INVERSE SCATTERING PROBLEM IN ONE DIMENSION
CASE, K.M.
ROCKEFELLER UNIV., N.Y., USA
J. MATH. PHYS., NEW YORK (USA) VOL.15, NO.2 143-6 FEB. 1974 Coden: JMAPAQ
Treatment: T
02
Languages: ENGLISH
GIVEN THE S-MATRIX, THE MATHEMATICAL PROBLEM OF FINDING THE POTENTIAL IS DISCUSSED FOR A DISCRETE ONE-DIMENSIONAL CASE. GENERAL FORMULAE ARE OBTAINED, AND, DESPITE THE DIFFERENCE FROM THE THREE-DIMENSIONAL CASE IN THE FORMULATION OF THE PROBLEM, THE SIMILARITY OF THE SOLUTIONS IS EMPHASISED, ESPECIALLY WHEN THE CONTINUOUS LIMIT IS TAKEN (3 Refs)
Descriptors: S-MATRIX THEORY
Identifiers: DISCRETE INVERSE SCATTERING PROBLEM; ONE DIMENSION; S-MATRIX; CONTINUOUS LIMIT
Section Class Codes: A3120
Unified Class Codes: GBEACV

822859 A7575274
GLOBAL SOLUTION TO THE SCALAR INVERSE SCATTERING PROBLEM
BATES, R.H.T.
ELECTRICAL ENGNG. DEPT., UNIV. OF CANTERBURY, CHRISTCHURCH, NEW ZEALAND
J. PHYS. A (GB) VOL.8, NO.8 L80-2 AUG. 1975 Coden: JPGPBA
Treatment: T
02
GIVEN THE SCALAR FIELDS INCIDENT UPON AND SCATTERED FROM A FINITE INHOMOGENEOUS REGION EXHIBITING ARBITRARY SPATIAL VARIATIONS OF REFRACTIVE INDEX IT IS SHOWN HOW TO CONSTRUCT A DETERMINANT WHICH DEPENDS ONLY ON THE REFRACTIVE INDEX WITHIN THE SCATTERING REGION AND THE FIELDS OUTSIDE THIS REGION. THE ANALYSIS IS SIMPLER, AND OF WIDER APPLICABILITY, THAN THE GEL'FAND-LEVITAN TECHNIQUE (5 Refs)
Descriptors: ACOUSTIC WAVE SCATTERING; QUANTUM THEORY; ELECTROMAGNETIC WAVE SCATTERING
Identifiers: SCALAR INVERSE SCATTERING PROBLEM; FINITE INHOMOGENEOUS REGION; ARBITRARY SPATIAL VARIATIONS OF REFRACTIVE INDEX; GLOBAL SOLUTION; INCIDENT SCALAR FIELDS
Section Class Codes: A1400, A9820, A2246
Unified Class Codes: DEAAKY, ZCCAAN, ECEEAW

Non-Uniqueness in the Inverse Source Problem in Acoustics and Electromagnetics

Denver Research Inst Colo Div of Mathematical Sciences*Office of Naval Research, Arlington, Va. (405751)

Technical rept.
AUTHOR: Bleistein, Norman; Cohen, Jack K.
C5843G3 Fld: 20A, 20N, 12A, 46 GRAI7605
Nov 75 36p
Rept No: MS-R-7609
Contract: N00014-76-C-0039, N00014-76-C-0079
Project: NR-083-364, NR-041-434
Monitor: 18

Abstract: It is shown that there exist physically realizable acoustic and electromagnetic sources for which the radiated field is exactly zero. Alternative analytical characterizations of these non-radiating sources are presented. Recently developed formulations of the inverse problem in acoustics and electromagnetics are introduced. The source is given as a solution of a Fredholm integral equation of the first kind. It is shown that the null space for this integral equation in each case is the class of non-radiating sources.

Descriptors: *Acoustic fields, *Electromagnetic fields, Wave equations, Integral equations, Maxwells equations, Theorems

Identifiers: *Inverse problems, Fredholm equations, NTISDODN

AD-A019 510/7ST NTIS Prices: PC A03/MF A01

Reformulation of the Plasma Inverse Scattering Problem

Naval Research Lab Washington D C (251950)

Interim rept.
AUTHOR: Szu, H. Harold; Carroll, C. E.; Ahn, Saeyoung
C5362C3 Fld: 20I GRA17524
Aug 75 14p
Rept No: NRL-MR-3108
Project: NRL-BOo-11, RR014-02
Task: RR014-02-41
Monitor: 18

Abstract: The one-dimensional problem of determining the density of a plasma from the reflection of electromagnetic waves has been solved by the Gel'fand-Levitan technique. Here their integral equation is modified and simplified. Laplace transformation gives a simple functional equation, and the asymptotic form of its solution yields the plasma density.

Descriptors: *Plasmas(Physics), *Electromagnetic wave reflections, Electron density, Laplace transformation, Integral equations

Identifiers: Inverse problems, NTISDODN

AD-A015 303/1ST NTIS Prices: PC A02/MF A01

547680 ID NO.- EI750747680
ON THE FEASIBILITY OF AN INVERSE SCATTERING METHOD.
Tabbara, W.
Ec Super d'Electr, Paris, Fr
IEEE Trans Antennas Propag v AP-23 n 3 May 1975 p 446-448
CODEN: IETPAK
This communication continues the investigation of R. Lewis' inverse scattering method. The purpose is first to show that the previously mentioned results can be significantly improved and then to point out the requirements for an experimental setup.
DESCRIPTORS: (*RADAR, *Cross Sections), (ELECTROMAGNETIC WAVES, Scattering).
CARD ALERT: 716, 711

538443 ID NO.- EI750638443
TWO RECONSTRUCTION METHODS FOR MICROWAVE IMAGING OF BURIED DIELECTRIC ANOMALIES.
Yue, On-Ching; Rope, E. L.; Tricoles, G.
Gen Dyn, San Diego, Calif
IEEE Trans Comput v C-24 n 4 Apr 1975 p 381-390 CODEN: ITCOB4
Microwave imaging of anomalies, such as voids or discontinuities, in optically opaque regions is described. Images were reconstructed with two techniques. The experimental technique utilized laser light for reconstructions from detour phase holograms that encoded data measured in the region of Fresnel diffraction. Examples of images are presented for smooth and rough interfaces. The numerical reconstruction technique was based on the angular spectrum technique, and an approximate propagator was derived to describe propagation through two, homogeneous dielectric layers to one anomaly. Image quality was acceptable for either reconstruction method, but the optically reconstructed images are rather small because scale reduction is limited in practice. 14 refs.
DESCRIPTORS: *HOLOGRAPHY, ELECTROMAGNETIC WAVES,
IDENTIFIERS: MICROWAVE IMAGING, MICROWAVE HOLOGRAPHY
CARD ALERT: 716, 743

Solution of the Inverse Scattering Problem by the Newton Method

Joint Inst. for Nuclear Research, Dubna (USSR). (3470000)
AUTHOR: Zhidkov, E. P.; Malyshev, R. V.; Khristov, E. Kh.
G1675E4 Fld: 20J, 46 GRAI8018
1975 38p
Language: RUSSIAN
In Russian.
U.S. Sales Only.

Abstract: A simple convergent process for the construction of the potential in Schrodinger equation for the scattering phase shift. Using Tikhonov regularization, a stable computing scheme is obtained. (Atomindex citation 10:431290)

Descriptors: *Inverse scattering problem, Accuracy, Iterative methods, Mathematical space, Numerical solution, Phase shift, Potential scattering, Projection operators, Schroedinger equation

Identifiers: ERDA/657002, Newton method, NTISINIS, NTISFNUR

JINR-R-5-9063 NTIS Prices: PC A03/MF A01

74092292 v2n10
Subsurface electrical profile determination
Lytle, R.J.
1974 International Institute of Electrical and Electronics Engineers/AP-S Symposium and USNC/International Union of Radio Science Meeting A742062 Atlanta, Ga 10-13 Jun 74
Institute of Electrical and Electronics Engineers; International Union of Radio Science
-URSI Abstracts," 14 Jun 74: $6.00: Mr. R. Y. Dow, USNC/URSI, c/o National Academy of Sciences, 2101 Constitution Ave., Washington, D. C. 20418. AP-S Digest available as IEEE Conference Publication No. 74CH0857-3AP, 14 Jun 74: $11.00: Order Dept., IEEE, 345 East 47 St., New York, N. Y. 10017.
Descriptors: SURFACE; ELECTRIC; PROFILE; DETERMINATION
SECTION HEADING: ELECTRONICS ENGINEERING
Section Class Codes: 4000

74105075 v2n11
Subsurface electrical profile determination--theory & experiment
Lytle, R.J.
1974 URSI Symposium on Electromagnetic Wave Theory B743121 London, UK 9-12 Jul 74
International Union of Radio Science--at the invitation of The Royal Society and the Institution of Electrical Engineers
Abstracts publication, Jul 74: Conference Dept., Institution of Electrical Engineers, Savoy Place London, WC2R 0BL, U.K.
Descriptors: SURFACE; ELECTRIC; PROFILE; DETERMINATION; THEORY
SECTION HEADING: ELECTRONICS ENGINEERING
Section Class Codes: 4000

690225 A7473575, B7437586
SUBSURFACE ELECTRICAL PROFILE DETERMINATION-THEORY AND EXPERIMENT
LYTLE, R.J.; LAINE, E.F.; LAGER, D.L.; OKADA, J.T.
LAWRENCE LIVERMORE LAB., CALIF., USA
UNION RADIO-SCI. INTERNAT
1974 URSI SYMPOSIUM ON ELECTROMAGNETIC WAVE THEORY 275-7 1974
9-12 JULY 1974 LONDON, ENGLAND
Publ: IEE LONDON, ENGLAND
XV+280 ISBN 0 85296128 6
Treatment: X
06
A VARIETY OF C.W. AND SWEPT FREQUENCY EXPERIMENTS WERE PERFORMED IN A PERMAFROST REGION OF THE BROOKS RANGE IN ALASKA. TWO DRILL HOLES, 600 FEET (180M) DEEP AND SEPARATED BY 550 FEET (170M) PERMITTED HOLE-TO-HOLE AND SURFACE-TO-HOLE TRANSMISSION MEASUREMENTS. AMPLITUDE AND PHASE INFORMATION WAS RECORDED FOR FREQUENCIES OF 1-50 MHZ. THIS DATA PERMITTED DETERMINATION OF THE CONDUCTIVITY SIGMA AND DIELECTRIC CONSTANT EPSILON OF THE SUBSURFACE MEDIUM BETWEEN THE DRILL HOLES FOR A VARIETY OF FREQUENCIES. AS MEASUREMENTS WERE TAKEN FOR NUMEROUS DEPTHS AND RELATIVE ORIENTATIONS OF SOURCE AND RECEIVER (BOTH DOWNHOLE AND ON THE SURFACE), A DETAILED SUBSURFACE PROFILE WAS OBTAINABLE. LEAST SQUARE MATRIX METHODS WERE USED TO INVERT THE DATA. VARIOUS WAYS OF COMBINING THE DATA YIELDED EQUIVALENT SUBSURFACE PROFILES. A DISCUSSION OF THE EXPERIMENTAL METHOD, EXPERIMENTAL RESULTS, THEORETICAL BASIS OF THE EXPERIMENT, DATA REDUCTION METHOD, AND DATA RESULTS ARE PRESENTED
Descriptors: TERRESTRIAL ELECTRICITY; GEOPHYSICAL TECHNIQUES; ELECTRICAL CONDUCTIVITY MEASUREMENT; PERMITTIVITY MEASUREMENT; SOIL
Identifiers: SUBSURFACE ELECTRICAL PROFILE DETERMINATION; SWEPT FREQUENCY EXPERIMENTS; PERMAFROST; ALASKA; CONDUCTIVITY; DIELECTRIC CONSTANT; EQUIVALENT SUBSURFACE PROFILES; LEAST SQUARE MATRIX DATA INVERSION; CW EXPERIMENTS
Section Class Codes: A9380, B4800, A0660, B4427
Unified Class Codes: ZKVAAT, BGMAAH, BKCRAG

509088 ID NO.- EI750209088
ON THE BOJARSKI-LEWIS INVERSE SCATTERING METHOD.
Perry, William L.
USAF Aerosp Res Lab
IEEE Trans Antennas Propag v AP-22 n 6 Nov 1974 p 826-829
CODEN: IETPAK
The authors assume that the backscattered electromagnetic far-field of a perfectly conducting scatterer is known for all aspects and for frequencies greater in magnitude than some positive number m. Then using standard integral equation techniques, they show how numerical instability enters into the N. Bojarski-R. Lewis inverse scattering method. Since the assumed knowledge of the backscattered field is even more complete than can be expected with radar, these results show that for radar applications the Bojarski-Lewis method is numerically unstable. Moreover, the degree of instability depends directly upon m. The more low frequency information one has, (i. e., the smaller m is), the more stable the method is. In the concluding remarks is noted a recent constrained Bojarski-Lewis method that overcomes much of the instability of the original unconstrained method studied here. 25 refs.
DESCRIPTORS: (*ELECTROMAGNETIC WAVES, *Scattering), (RADAR, Reflection),
CARD ALERT: 711, 716

656574 A7451274
ON INVERSE SCATTERING
WESTON, V.H.
PURDUE UNIV., WEST LAFAYETTE, IND., USA
J. MATH. PHYS., NEW YORK (USA) VOL.15, NO.2 209-13
FEB. 1974 Coden: JMAPAQ
Treatment: T
02
THE COEFFICIENTS OF A HYPERBOLIC DISPERSIVE PARTIAL

DIFFERENTIAL EQUATION WERE PREVIOUSLY SHOWN TO BE GIVEN IN TERMS OF A DUAL SET OF INTEGRAL EQUATIONS INVOLVING MEASURABLE QUANTITIES AND THE KERNELS OF THE REFLECTION AND TRANSMISSION OPERATORS. TO DETERMINE AN UNKNOWN PARAMETER OF THESE EQUATIONS AN AUXILIARY EQUATION IS USED. THE UNIQUENESS OF THE SOLUTION OF THE RESULTANT SYSTEM IS SHOWN FOR A CERTAIN CLASS OF PROBLEMS. THE USE OF AN ADDITIONAL EQUATION RESULTS IN UNIQUENESS UNDER VERY GENERAL CONDITIONS (3 Refs)
Descriptors: SCATTERING; INTEGRAL EQUATIONS
Identifiers: INVERSE SCATTERING; HYPERBOLIC DISPERSIVE PARTIAL DIFFERENTIAL EQUATION; DUAL SET OF INTEGRAL EQUATIONS; TRANSMISSION OPERATORS; UNIQUENESS; REFLECTION OPERATORS
Section Class Codes: A1120
Unified Class Codes: DBEAFJ

751330 ID NO.- EI770751330
PROFILE INVERSION OF SIMPLE PLASMAS AND NONUNIFORM REGIONS: THREE-POLE REFLECTION COEFFICIENT.
Ahn, Saeyoung; Jordan, Arthur K.
Nav Res Lab, Washington, DC
IEEE Trans Antennas Propag v AP-24 n 6 Nov 1976 p 879-882
CODEN: IETPAK
A mathematical method for the reconstruction of the electron density profile N(x) for an inhomogeneous, stratified, simple plasma is presented. If the reflection coefficient r(k) of the incident probing electromagnetic wave is approximated by a third-order rational approximation, then profiles can be obtained which are similar to profiles obtained from simulated VHF satellite tracking data. The method is based upon the solution of the fundamental integral equation of inverse scattering (Gelfand-Levitan) theory. Using this theory it is possible to obtain an analytical expression for N(x) as a function of distance x in the plasma if r(k) is a rational function of the wave number k. The integral equation is solved by the Laplace transform technique and checked by the differential operator technique. The method is exact once the functional form of r(k) is determined. Thus this analysis can supplement information about profiles which are obtained from calculations based on the WKB approximation (which approximation can also be applied to calculate the local wave impedance W(x) for propagation in nonuniform regions). The functional characteristics of N(x) depend on the pole positions of r(k) in the complex k plane. By calculating the variations in N(x) due to variations in these pole positions, it is possible to set a finite error bound on the profile of the electron density if the error bound in the rational approximation to the reflection coefficient is known. 11 refs.
DESCRIPTORS: (*PLASMAS, *Density), (ELECTROMAGNETIC WAVES, Reflection), (MATHEMATICAL TECHNIQUES, Integral Equations), (MATHEMATICAL TRANSFORMATIONS, Laplace Transformers).
CARD ALERT: 932, 711, 921

060744 A78038103
ON THE INVERSE SCATTERING PROBLEM FOR THE EQUATION OF ACOUSTICS
AVILA, G.S.S.
DEPT. DE MATEMATICA, INST. DE CIENCIAS EXATAS, UNIV. DE BRASILIA, BRASILIA, BRAZIL
AN. ACAD. BRAS. CIENC. (BRAZIL) VOL.48, NO.4 663-6 1976 Coden: AABCAD
Treatment: THEORETICAL-
JOURNAL PAPER-
IT IS SHOWN THAT RESULTS (MENZLA (1976)) FOR THE INVERSE SCATTERING PROBLEM FOR THE EQUATION U/SUB TT/-DELTAU+Q(X)U=0 CAN BE EXTENDED TO THE ACOUSTIC EQUATION V/SUB TT/-NU(X)NABLA.(NABLAV/NU(X))=0. THE PROPAGATION OF ACOUSTIC WAVES IN A NONHOMOGENEOUS MEDIUM OF VARIABLE DENSITY NU(X) IS CONSIDERED AS A PERTURBATION OF PROPAGATION IN A HOMOGENEOUS MEDIUM OF CONSTANT DENSITY NU=1 (6 Refs)
Descriptors: ACOUSTIC WAVE PROPAGATION; ACOUSTIC WAVE SCATTERING
Identifiers: INVERSE SCATTERING PROBLEM; ACOUSTIC EQUATION; NONHOMOGENEOUS MEDIUM; HOMOGENEOUS MEDIUM; ACOUSTIC WAVE PROPAGATION
Section Class Codes: A4320

988817 A7692798
AN EXTENDED RYTOV APPROXIMATION AND ITS SIGNIFICANCE FOR REMOTE SENSING AND INVERSE SCATTERING
BATES, R.H.T.; BOERNER, W.M.; DUNLOP, G.R.
ELECTRICAL ENGNG. DEPT., UNIV. OF CANTERBURY, CHRISTCHURCH, NEW ZEALAND
OPT. COMMUN. (NETHERLANDS) VOL.18, NO.4 421-3 SEPT. 1976 Coden: OPCOB8
Treatment: T
O2
THE BORN APPROXIMATION HAS BEEN SHOWN BY WOLF TO BE PARTICULARLY CONVENIENT FOR FORMULATING INVERSE SCATTERING PROBLEMS. THE RYTOV APPROXIMATION IS KNOWN TO BE MORE WIDELY APPLICABLE THAN THE BORN APPROXIMATION. AN IMPROVEMENT IS INTRODUCED THAT FURTHER INCREASES THE RANGE OF VALIDITY OF THE RYTOV APPROXIMATION. IT TRANSPIRES THAT THE EXTENSION OF THE RYTOV APPROXIMATION IS AS CONVENIENT FOR INVERSE SCATTERING AS THE BORN APPROXIMATION (9 Refs)
Descriptors: LIGHT SCATTERING; ELECTROMAGNETIC WAVE SCATTERING; REMOTE SENSING
Identifiers: EXTENDED RYTOV APPROXIMATION; REMOTE SENSING;

1027937 A77023789
PHYSICAL OPTICS FARFIELD INVERSE SCATTERING IN THE TIME DOMAIN
BLEISTEIN, N.
DEPT OF MATH., UNIV OF DENVER, DENVER, CO, USA
J ACOUST SOC AM (USA) VOL 60, NO.6 1249-55 DEC. 1976 Coden JASMAN
Treatment T
O2
A PHYSICAL OPTICS FARFIELD INVERSE SCATTERING IDENTITY RELATING THE PHASE- AND RANGE-NORMALISED BACKSCATTERING AMPLITUDE TO THE CHARACTERISTIC FUNCTION OF THE SCATTERER WHICH PRODUCED THE SIGNAL, WAS FIRST DERIVED BY BOJARSKI (1967) IN THE CASE OF IMPULSIVE POINT SOURCES. IN THE PRESENT PAPER THE WORK IS EXTENDED TO INCLUDE POINT SOURCES WITH A MORE GENERAL TEMPORAL DEPENDENCE AND ADVANTAGE IS TAKEN OF PREVIUSLY UNOBSERVED SYMMETRIES TO SIMPLIFY THE SPATIAL INVERSION LEADING TO THE CHARACTERISTIC FUNCTION. AN ALTERNATIVE FORM OF BOJARSKI'S IDENTITY IS OBTAINED TOGETHER WITH AN IDENTITY IN THE TIME DOMAIN. THE IDENTITY IS TESTED USING ANALYTICALLY DERIVED BACKSCATTERED DATA FOR A SPHERE. THE DERIVATIVE OF THE CHARACTERISTIC FUNCTION IS CALCULATED, BEING NON-ZERO ONLY ON THE BOUNDARY OF THE SPHERE, THE ANGULAR INTEGRATION IS CARRIED OUT ANALYTICALLY AND THE INTEGRATION OVER FREQUENCY IS CARRIED OUT NUMERICALLY. BAND LIMITING IS CHECKED BY VARYING THE UPPER AND LOWER LIMITS IN THE LATTER CASE (9 Refs)
Descriptors: ACOUSTIC WAVE SCATTERING
Identifiers: TIME DOMAIN; PHYSICAL OPTICS; FARFIELD INVERSE SCATTERING; CHARACTERISTIC FUNCTION; POINT SOURCES; BOJARSKI'S IDENTITY
Section Class Codes: A4320

Inverse Source Problem: Eigenfunction Analysis of Bojarski's Integral Equation

Denver Research Inst Colo Div of Mathematical Sciences (405751)

Technical rept.
AUTHOR: Cohen, Jack K.; Bleistein, Norman
C6714J4 Fld: 12A, 46, 72B GRAI7615
25 Apr 76 20p
Rept No: MS-R-7616
Contract: N00014-76-C-0079, N00014-76-C-0039
Project: NR-041-434, NR-083-364
Monitor: 18

Abstract: An integral equation elsewhere employed to solve *inverse source problems* is discussed from the viewpoint of Hilbert Space theory. The eigenfuctions and eigenvalues are determined and the null space is explicitly shown to be infinite dimensional. An existence criterion is established and application is made to the problem of determining sources which radiate maximum power for given input power. (Author)

Continuity of the Direct and Inverse Problems in One-Dimensional Scattering Theory and Numerical Solution of *the Inverse Problem*

Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro. (1652000)
AUTHOR: de Moura, C. A.
G1262J4 Fld: 20H, 46 GRAI8015
Sep 76 60p
U.S. Sales Only.

Abstract: We propose an algorithm for computing the potential V(x) associated to the one-dimensional Schroedinger operator E identical to - d sub 2 /dx sub 2 + V(x) -infinite <x< infinite from knowledge of the S.matrix, more exactly, of one of the reelection coefficients. The convergence of the algorithm is guaranteed by the stability results obtained for both the direct and inverse problems. (Atomindex citation 10:438587)

Descriptors: *Inverse scattering problem, *Potential scattering, *Scattering, *Schroedinger equation, Algorithms, Numerical solution, One-dimensional calculations
Identifiers: ERDA/645500, ERDA/657002, Brazil, NTISINIS, NTISFNBR

CBPF-A0026/76 NTIS Prices: PC A04/MF A01

1022482 A77019145, B77010130
ON AN EXTENDED RYTOV APPROXIMATION AND ITS COMPARISON WITH THE BORN APPROXIMATION
DUNLOP, G.R.; BOERNER, W.M.; BATES, R.H.T.
DEPT. OF ELECTRICAL ENGNG., UNIV. OF CANTERBURY, CHRISTCHURCH, NEW ZEALAND
IEEE, URSI
AP-S INTERNATIONAL SYMPOSIUM 1976 587-91 1976
11-15 OCT. 1976 AMHERST, MASS., USA
Publ: IEEE NEW YORK, USA
IX+613
Treatment: AT
06
IN REMOTE SENSING PROBLEMS FOR CONTINUOUS INHOMOGENEOUS MEDIA, THE BORN APPROXIMATION IS USED CONVENIENTLY FOR TENUOUS, SLOWLY CHANGING MEDIA. THE RYTOV APPROXIMATION IS KNOWN, UNDER CERTAIN CIRCUMSTANCES, TO GIVE MORE ACCURATE INDICATION AND THE AUTHORS HAVE INTRODUCED AN IMPROVEMENT THAT FURTHER INCREASES ITS RANGE OF VALIDITY. SOME NUMERICAL RESULTS ARE PRESENTED TO ILLUSTRATE ITS ADVANTAGES (10 Refs)
Descriptors: REMOTE SENSING; ELECTROMAGNETIC WAVE PROPAGATION
Identifiers: EXTENDED RYTOV APPROXIMATION; BORN APPROXIMATION; REMOTE SENSING; CONTINUOUS INHOMOGENEOUS MEDIA; VALIDITY; NUMERICAL RESULTS
Section Class Codes: A4110H, B5210, B7730

962176 A7678097
INVERSE SCATTERING PROBLEMS IN ABSORBING MEDIA
JAULENT, M.
DEPT. OF PHYS. MATH., UNIV. DES SCI. TECH. DU LANGUEDOC, MONTPELLIER, FRANCE
J. MATH. PHYS., NEW YORK (USA) VOL.17, NO.7 1351-60 JULY 1976 Coden: JMAPAQ
Treatment: T
02
IT IS SHOWN HOW TO REDUCE INVERSE SCATTERING PROBLEMS OCCURRING IN VARIOUS BRANCHES OF PHYSICS TO AN INVERSE SCATTERING PROBLEM FOR THE RADIAL S-WAVE SCHRODINGER EQUATION WITH AN ENERGY-DEPENDENT POTENTIAL. VARIOUS SPECIAL CASES ARE INVESTIGATED (16 Refs)
Descriptors: SCHRODINGER EQUATION
Identifiers: ABSORBING MEDIA; INVERSE SCATTERING PROBLEMS; RADIAL S-WAVE SCHRODINGER EQUATION; ENERGY DEPENDENT POTENTIAL
Section Class Codes: A1400
Unified Class Codes: DEAAKY

717811 ID NO.- EI770317811
3-D DISTRIBUTION OF SOURCES OF OPTICAL SCATTERING COMPUTED FROM COMPLEX-AMPLITUDE FAR-FIELD DATA.
Lam, D. K.; Schmidt-Weinmar, H. G.; Wouk, A.
Univ of Alberta, Edmonton
Can J Phys v 54 n 19 Oct 1976 p 1925-1936 CODEN: CJPHAD
A fast computer algorithm is presented to solve the scalar inverse scattering problem numerically by inverting a linear transformation which maps a 3-D distribution of scattering sources into the angular distribution of the resultant scattered far field. It is shown how an approximate solution to the problem can be found in discrete form which leads to non-singular systems of linear equations of a type whose matrix can be inverted readily by fast algorithms. The method uses Born's first approximation and is valid for a slowly varying refractive index: the resultant numerical problem can be solved by a fast algorithm which reduces computing time by about 10** $minus$ **7, storage requirement by about 10** $minus$ **5, as compared with Gaussian elimination applied to 125,000 sample points. With this algorithm, computerized 3-D reconstruction becomes feasible. 22 refs. 1
DESCRIPTORS: (*LIGHT, *Scattering),
CARD ALERT: 741

76101411
Formal solutions of inverse scattering problems. II
Prosser, Reese T.
Department of Mathematics, Dartmouth College, Hanover, New Hampshire 03755
J. Math. Phys. (N.Y.)17(10),1775-1779 (OCT. 1976) CODEN: JMAPA
CPM: 7610-A-0061
WORK TYPE: THEORETICAL
PACS: *03.65.N
The formal solutions of inverse scattering problems presented in Paper I (J. Math. Phys. 10, 1819 (1969)) are shown here to converge in certain cases of potential scattering for sufficiently weak potentials, and in certain cases of refractive scattering for sufficiently weak variations in the index of refraction. The solutions for the cases of boundary scattering, on the other hand, are not likely to converge, because there is no way to make the effect of the boundary sufficiently weak.

IDENTIFICATION OF BURIED DIELECTRIC ANOMALIES BY ALGEBRAIC PROCESSING OF MICROWAVE REFLECTIONS

ROPE, E.L.; HAYWARD, R.A.; ON-CHING YUE; TRICOLES, G.

GENERAL DYNAMICS ELECTRONICS DIV., SAN DIEGO, CA, USA

IEEE, SOC. PHOTO-OPTICAL INSTRUMENTATION ENGRS.

INTERNATIONAL OPTICAL COMPUTING CONFERENCE. (DIGEST OF PAPERS) 12-14 1976

31 AUG. - 2 SEPT. 1976 CAPRI, ITALY

Publ: IEEE NEW YORK, USA

VIII+150

Treatment: A

06

THE METHOD CAN DETERMINE THE DEPTH AND THICKNESS OF A BURIED LAYER, AND CAN ESTIMATE LATERAL DIMENSIONS. THE PROCEDURE IS TO MEASURE THE PHASE AND INTENSITY OF THE MICROWAVE FIELD REFLECTED IN A MONOSTATIC ARRANGEMENT IN WHICH AN ANTENNA BOTH RADIATES AND RECEIVES WHILE SCANNING A LINEAR PATH. AN ARRAY OF ANTENNAS COULD BE SCANNED IN THE DIRECTION ORTHOGONAL TO ITS LENGTH TO ELIMINATE REPETITIVE SCANNING (6 Refs)

Descriptors: GEOPHYSICAL TECHNIQUES; MICROWAVE MEASUREMENT; RADAR APPLICATIONS; SCANNING ANTENNAS; OPTICAL INFORMATION PROCESSING; ELECTRONICS APPLICATIONS OF COMPUTERS

Identifiers: BURIED DIELECTRIC ANOMALIES; ALGEBRAIC PROCESSING; MICROWAVE REFLECTIONS; DEPTH; THICKNESS; LATERAL DIMENSIONS; MONOSTATIC ARRANGEMENT; SCANNING

Section Class Codes: B4800, B3640, C8842, B4425, C7425

Unified Class Codes: ZKVAAT, FGEAAL, WMEEAQ, BKCMAK

1053023 A77031048, B77021621

INVERSE SCATTERING METHODS

USLENGHI, P.L.E.

DEPT. OF INFORMATION ENGNG., UNIV. OF ILLINOIS, CHICAGO, IL, USA

ALTA FREQ. (ITALY) VOL.45, NO.10 629-32 OCT. 1976

Coden: ALFRAJ

Treatment: T

02

A SURVEY OF PRESENTLY AVAILABLE METHODS IN INVERSE SCATTERING FOR ELECTROMAGNETIC FIELDS, WITH A SELECTED BIBLIOGRAPHY (17 Refs)

Descriptors: ELECTROMAGNETIC WAVE SCATTERING; BACKSCATTER; PHYSICAL OPTICS

Identifiers: INVERSE SCATTERING; ELECTROMAGNETIC FIELDS; BIBLIOGRAPHY; BACK SCATTERING; ANALYTIC CONTINUATION; VECTOR FIELD; WAVE EQUATION; PHYSICAL OPTICS; INVERSE BOUNDARY CONDITIONS

Section Class Codes: A4110H, A4210H, B5210

095769 A78061231, B78035780

INVERSE SCATTERING AND TOMOGRAPHY

BATES, R.H.T.; DUNLOP, G.R.

ELECTRICAL ENGNG. DEPT., UNIV. OF CANTERBURY, CHRISTCHURCH, NEW ZEALAND

JOURNAL ULTRASONICS

ULTRASONICS INTERNATIONAL 1977 104-10 1977

28-30 JUNE 1977 BRIGHTON, ENGLAND

Publ: IPC SCI. AND TECHNOL. PRESS GUILDFORD, ENGLAND

507 ISBN 0 902852 76 0

Treatment: APPLIC~

REPORT SECTION~

AN EXPERIMENTAL APPARATUS IS OUTLINED. IMAGES RECONSTRUCTED FROM ULTRASONIC TRANSMISSION MEASUREMENTS ARE PRESENTED. IT IS SUGGESTED HOW AN EXTENSION OF THE RYTOV-APPROXIMATION FORMULATION OF INVERSE SCATTERING THEORY COULD BE ADAPTED TO IMPROVE THE QUALITY OF THE RECONSTRUCTED IMAGES (13 Refs)

Descriptors: BIOMEDICAL ULTRASONICS; ULTRASONIC SCATTERING; ACOUSTIC IMAGING

Identifiers: TOMOGRAPHY; ULTRASONIC TRANSMISSION MEASUREMENTS; INVERSE SCATTERING THEORY; IMAGE RECONSTRUCTION; ULTRASONIC IMAGING; RYTOV APPROXIMATION

Electromagnetic Remote Sensing of Inhomogeneous Media

National Bureau of Standards, Boulder, Colo. Electromagnetics Div.;*Colorado Univ., Boulder. (390 891)
AUTHOR: Bereuter, Wolfgang A.; Chang, David C.
D1941B3 Fld: 20N, 46H, 86V GRA17710
Jan 77 21p
Rept No: NBSIR-76-851
Project: NBS-2762275
Monitor: 18
Prepared by Colorado Univ., Boulder.

Abstract: This report deals with the electromagnetic response of inhomogeneous dielectrics, i.e., media whose permittivity is a function of depth. The resulting boundary value problem is solved for a large number of permittivity functions which can model almost any medium of interest. Since those permittivity profiles are characterized by only a few parameters, they are particularly useful for the inverse problem: i.e., the retrieval of profiles from the measured electromagnetic response. It is shown how the non-uniformity of the permittivity changes the response and how the change is related to the profile characteristics.

Descriptors: *Microwaves, *Remote sensing, Dielectric properties, Wave equations, Hypergeometric functions, Mathematical models, Boundary value problems

Identifiers: Inverse scattering, Inverse problems, NTISCOMNBS

PB-263 124/OST NTIS Prices: PC A02/MF A01

A Survey of Recent Progress on Inverse Problems

Denver Univ Colo Dept of Mathematics (406854)

Technical rept.
AUTHOR: Bleistein, Norman; Cohen, Jack K.
E14221 2 Fld: 12A, 20A, 20F, 72, 63F, 63I GRA17815
1 Dec 77 71p
Rept No: MS-R-7806
Contract: N00014-76-C-0079
Monitor: 18

Abstract: Over the past few years, the authors have been engaged in a coordinated research program on inverse problems. By this time, the results have been spread over a number of different papers. This review provides an opportunity to collect those results, to filter some of the work that has proven to be of less interest and to incorporate into the presentation new insights that have been developed during this research project. This report describes the three main segments in the research program: physical optics farfield inverse scattering (denoted by the alliteration POFFIS); seismic or subsurface profiling in media with small variations in propagation speed; analysis of the inverse source problem. (Author)

Descriptors: *Inverse scattering, *Acoustic scattering, *Acoustic waves, Fourier analysis, Green's function, Wave propagation, Backscattering, Apertures, Seismic detection

Identifiers: NTISDODXA

AD-A052 908/1ST NTIS Prices: PC A04/MF A01

A Note on the Inverse Source Problem

Denver Univ Colo Dept of Mathematics (406854)

Technical rept.
AUTHOR: Bleistein, Norman; Cohen, Jack K.
E142213 Fld: 20A, 12A, 46A GRAI7815
15 Dec 77 9p
Rept No: MS-R-7807
Contract: N00014-76-C-0039
Monitor: 18

Abstract: In an earlier paper, the authors derived a Fredholm integral equation of the first kind for the solution of the inverse source problem for acoustic waves. The eigenvalues of this equation were shown to converge rapidly to zero and also to include zero. Thus, the solution was shown to be non-unique and even the particular part of the solution of that equation was ill-conditioned. In this note it is shown how to obtain the non-trivial information of that integral equation in a well-conditioned manner. (Author)

Descriptors: *Inverse scattering, *Acoustic scattering, *Acoustic waves, Integral equations, Convergence, Harmonics, Green's function

Identifiers: Fredholm equations, NTISDODXA

AD-A052 909/9ST NTIS Prices: PC A02/MF A01

1036433 A77030015
NONUNIQUENESS IN THE INVERSE SOURCE PROBLEM IN ACOUSTICS AND ELECTROMAGNETICS
BLEISTEIN, N.; COHEN, J.K.
DEPT. OF MATH., UNIV. OF DENVER, DENVER, CO, USA
J. MATH. PHYS., NEW YORK (USA) VOL.18, NO.2 194-201 FEB. 1977 Coden: JMAPAQ
Treatment: T
02
THE INVERSE SOURCE PROBLEM FOR THE SCALAR WAVE EQUATION IS CONSIDERED. BY USING A FREDHOLM INTEGRAL EQUATION FORMULATION IT IS SHOWN THAT THE SOLUTION IS NOT UNIQUE; THIS NONUNIQUENESS IS RELATED TO FEATURES OF THE DIRECT RADIATION PROBLEMS (8 Refs)
Descriptors: ACOUSTIC WAVES; ELECTROMAGNETIC WAVES; WAVE EQUATIONS
Identifiers: ACOUSTICS; ELECTROMAGNETICS; INVERSE SOURCE PROBLEM; SCALAR WAVE EQUATION; FREDHOLM INTEGRAL EQUATION; DIRECT RADIATION PROBLEMS; WAVE EQUATIONS
Section Class Codes: A0340K, A4110H, A4320

041803 A78025953, B78015028
REFRACTIVE-INDEX PROFILE DETERMINATION OF OPTICAL FIBERS FROM THE DIFFRACTION PATTERN
BRINKMEYER, E.
UNIV. WUPPERTAL, WUPPERTAL, GERMANY
APPL. OPT. (USA) VOL.16, NO.11 2802-3 NOV. 1977 Coden: APOPAI
Treatment: THEORETICAL-EXPERIMENTAL-
JOURNAL PAPER-
SHOWS HOW THE REFRACTIVE INDEX PROFILE OF A FIBRE CAN BE OBTAINED AS A HANKEL TRANSFORM OF THE FAR-FIELD DIFFRACTION PATTERN (2 Refs)
Descriptors: OPTICAL FIBRES; REFRACTIVE INDEX MEASUREMENT; LIGHT DIFFRACTION
Identifiers: DIFFRACTION PATTERN; HANKEL TRANSFORM; REFRACTIVE INDEX PROFILE DETERMINATION; OPTICAL FIBRES
Section Class Codes: A4280M, A0760H, B4130, B7320P

828539 ID NO.- EI780428539
SCATTERING OF RADIO WAVES BY A PLASMA CYLINDER.
Chumak, Yu. V.; Moisya, R. I.
Kiev State Univ, Ukr SSR
Radiophys Quantum Electron v 20 n 1 Jan 1977 p 34-37
CODEN: RPQEAC
The scattering of radio waves by an infinite plasma cylinder in a vaccum with a Gaussian distribution of electrons along its radius is discussed. The problem is solved numerically by two methods: power series and the Runge-Kutta method. The inverse scattering coefficient and the phase of the reflected signal are found in the case of parallel and perpendicular polarization. It is shown that the polarization ratio does not exceed two. The problem is also solved for arbitrary polarization of the incident electromagnetic wave. 10 refs.
DESCRIPTORS: (*RADIO TRANSMISSION, *Scattering), (PLASMAS, Cylinders),
CARD ALERT: 716, 932

A Velocity Inversion Procedure for Acoustic Waves

Denver Research Inst Colo Div of Mathematical Sciences (405751)

Technical rept.
AUTHOR: Cohen, Jack K.; Bleistein, Norman
E1422J2 Fld: 8K, 48F GRAI7815
22 Aug 77 31p
Rept No: MS-R-7803
Contract: N00014-76-C-0039, N00014-76-C-0079
Monitor: 18

Abstract: An approximate solution is presented to the seismic inverse problem for two dimensional velocity variations. The solution is given as a multiple integral over the data observed at the upper surface. An acoustic model is used and the reflections are assumed to be sufficiently weak to allow a linearization procedure in the otherwise non-linear inverse problem. Synthetic examples are presented demonstrating accuracy of the method with dipping planes at angles up to 45 deg and with velocity variations up to 20%. The method was also tested under automatic gain contro. in which case velocity estimates were lost but the method nonetheless successfully migrated the data. (Author)

Descriptors: *Seismic waves, *Acoustic waves, Inverse scattering, Backscattering, Two dimensional, Variations, Velocity, Automatic gain control, Experimental data, Mathematical models

Identifiers: Inverse problems, NTISDODXA

AD-A052 912/3ST NTIS Prices: PC A03/MF A01

1110261 A77079732, B77037161
EXACT SOLUTION TO AN INVERSE SCATTERING PROBLEM
COEN, S.
DEPT. OF ELECTRICAL ENGNG., UNIV. OF CALIFORNIA, BERKELEY, CA, USA
IEEE, URSI
AP-S INTERNATIONAL SYMPOSIUM 1977 578-80 1977
20-22 JUNE 1977 STANFORD, CALIF., USA
Publ: IEEE NEW YORK, USA
613
Treatment: T
06
THE METHOD PROPOSED MAY BE APPLIED TO LOSSY DIELECTICS AND REQUIRES THE REFLECTION COEFFICIENT AMPLITUDE AND PHASE, BUT ONLY AT THREE DISCRETE EQUALLY-SPACED FREQUENCIES (2 Refs)
Descriptors: ELECTROMAGNETIC WAVE SCATTERING; DIELECTRIC LOSSES; REFLECTIVITY
Identifiers: INVERSE SCATTERING PROBLEM; LOSSY DIELECTICS; REFLECTION COEFFICIENT; EXACT SOLUTION
Section Class Codes: A4110H, B5210C, B2810

A Generalization of the Direct and Inverse Problem for the Radial Schroedinger Equation

Lowell Univ Research Foundation MA (409596)
AUTHOR: Moses, Harry E.
F0705E2 Fld: 12A, 20J, 46, 72B GRAI7910
2 May 77 22p
Rept No: ULRF-397/CAR
Grant: AFOSR-77-3169
Project: 2304
Task: A4
Monitor: AFOSR-TR-78-1552
Availability: Pub. in Studies in Applied Mathematics, v58 p187-207 1978.

Abstract: No abstract available.

Descriptors: *Schrodinger equation, Operators(Mathematics), Inverse scattering, Hilbert space, Boundary value problems, Applied mathematics, Reprints

Identifiers: Inverse problems, NTISDODXR

AD-A062 919/6ST NTIS Prices: PC A02/MF A01

1105045 A77075395, B77037132
A DISCRETE SAMPLING APPROACH TO THE INVERSE SCATTERING PROBLEM
JEDRZEJEWSKI, P.; KRITIKOS, H.
NAVAL AIR DEV. CENTER, JOHNSVILLE, PA, USA
IEEE, URSI
AP-S INTERNATIONAL SYMPOSIUM 1977 574-7 1977
20-22 JUNE 1977 STANFORD, CALIF., USA
Publ: IEEE NEW YORK, USA
613
Treatment: T
06
ANALYTIC CONSIDERATIONS REQUIRE THAT THE SCATTERING DATA, IN THE FORM OF THE REFLECTION COEFFICIENT, BE KNOWN FOR ALL FREQUENCIES FROM -INFINITY TO +INFINITY. IN PRACTICE IT IS FEASIBLE TO TAKE ONLY A FINITE NUMBER OF FREQUENCY READINGS. AN APPROACH IS PRESENTED WHICH BRIDGES THE GAP BETWEEN THE ANALYTICAL AND THE PRACTICAL. TWO METHODS ARE APPLIED TO DATA RESULTING FROM THE FREQUENCY SAMPLING OF A HYPOTHETICAL THIRD ORDER BODY, THAT IS, A BODY WHOSE SCATTERING DATA RESULTS IN A THIRD ORDER RATIONAL REFLECTION COEFFICIENT. THE RESULTS ARE USED IN CONJUNCTION WITH THE GELFAND-LEVITAN EQUATION AND SOLVED BY KAY'S METHOD TO ARRIVE AT AN ESTIMATED EXPRESSION FOR THE POTENTIAL ARISING FROM THE CONSTRUCTED REFLECTION COEFFICIENTS TO THE ACTUAL POTENTIAL OF THE HYPOTHETICAL THIRD ORDER BODY (4 Refs)
Descriptors: ELECTROMAGNETIC WAVE SCATTERING
Identifiers: DISCRETE SAMPLING APPROACH; INVERSE SCATTERING PROBLEM; SCATTERING DATA; REFLECTION COEFFICIENT; FREQUENCY SAMPLING; GELFAND LEVITAN EQUATION; KAY'S METHOD
Section Class Codes: A4110H, B5210

Fast Algorithms for the Integral Equations of the Inverse Scattering Problem

Stanford Univ CA Dept of Electrical Engineering (400852)
AUTHOR: Anderson, B. D. O.; Kailath, Thomas
F0704L1 Fld: 12A, 72B GRAI7910
1978 6p
Contract: F44620-74-C-0068, DAAG29-77-C-0042
Project: 2304
Task: A6
Monitor: AFOSR-TR-78-1562
Availability: Pub. in Integral Equations and Operator Theory, v1 n1 p1-5 1978.

Abstract: No abstract available.

Descriptors: *Inverse scattering, *Integral equations, Algorithms, Operators(Mathematics), Reprints

Identifiers: NTISDODXR

AD-A062 898/2ST NTIS Prices: PC A02/MF A01

A Wave Equation for Radiating Source Distributions

Bojarski (Norbert N) Newport Beach Ca (389425)

Scientific rept.
AUTHOR: Bojarski, Norbert N.
E1294H2 Fld: 20C, 46 GRA17814
Feb 78 13p
Contract: N00014-76-C-0082
Monitor: 18

Abstract: The Bleistein Cohen separation of a source (for the inhomogeneous Helmholtz wave equation) distribution into radiating and non-radiating portions is reformulated into a form suitable for deriving a wave equation governing the radiating portion of the source distribution. (Author)

Descriptors: *Inverse scattering, Sources, Distribution functions, Wave equations, Radiation, Separation, Maxwells equations, Bessel functions

Identifiers: *Helmholtz equation, NTISDODXA

AD-A052 590/7ST NTIS Prices: PC A02/MF A01

102826 A78065820
NONUNIQUENESS IN THE INVERSE SCATTERING PROBLEM
DEVANEY, A.J.
EIKONIX CORP., BURLINGTON, MA, USA
J. MATH. PHYS. (USA) VOL.19, NO.7 1526-31 JULY 1978
Coden: JMAPAQ
Treatment: THEORETICAL~
JOURNAL PAPER~
IT IS SHOWN THAT WITHIN THE FRAMEWORK OF THE FIRST BORN APPROXIMATION THE INVERSE SCATTERING PROBLEM AS DEFINED ABOVE DOES NOT POSSESS A UNIQUE SOLUTION. IT IS ALSO SHOWN THAT WITHIN THE FRAMEWORK OF EXACT (POTENTIAL) SCATTERING THEORY THE PROBLEM DOES NOT ADMIT A UNIQUE SOLUTION GIVEN ONLY THE SCATTERING MATRIX FOR A SINGLE FIXED VALUE OF THE WAVE VECTOR K/SUB O/S/SUB O/ AS DATA. THE FINAL SECTION IN THE PAPER CONSIDERS SCATTERING EXPERIMENTS USING INCIDENT FIELDS OTHER THAN PLANE WAVES AND WHERE KNOWLEDGE OF THE SCATTERED FIELD AT ALL POINTS EXTERIOR TO THE SCATTERING VOLUME IS AVAILABLE AS DATA. IT IS FOUND THAT, WITHIN THE FRAMEWORK OF EXACT SCATTERING THEORY, THE DATA GENERATED BY ANY SINGLE SUCH EXPERIMENT IS NOT SUFFICIENT TO UNIQUELY SPECIFY THE SCATTERING POTENTIAL WHILE, WITHIN THE FRAMEWORK OF THE FIRST BORN APPROXIMATION, THE DATA GENERATED BY ANY FINITE NUMBER OF SUCH EXPERIMENTS IS NOT SUFFICIENT TO UNIQUELY SPECIFY THE POTENTIAL (19 Refs)
Descriptors: POTENTIAL SCATTERING; QUANTUM THEORY
Identifiers: INVERSE SCATTERING PROBLEM; FIRST BORN APPROXIMATION; EXACT (POTENTIAL) SCATTERING THEORY; EXACT SCATTERING THEORY
Section Class Codes: A0380, A0365N

226960 A79048586
INFRARED REMOTE TEMPERATURE MEASUREMENTS' ITS PHYSICS WITH REFERENCE TO COMPLEXITIES, APPROXIMATIONS AND LIMITATIONS INVOLVED. II. TEMPERATURE PROFILE RETRIEVAL
GUPTA, R.K.
INDIAN INST. OF TROPICAL METEOROLOGY, PUNE, INDIA
J. INDIAN INST. SCI. VOL.60, NO.10 253-84 OCT. 1978
Coden: JIISAD
Treatment: THEORETICAL-
JOURNAL PAPER-
WITH A TENTATIVE INCLINATION TO COMPLEXITY, APPROXIMATION AND LIMITATION ASPECTS OF THE PROCESS OF TEMPERATURE PROFILE DETERMINATION IN CLOUDLESS CONDITIONS THE EFFECT OF AN @A PRIORI@ STATISTICAL CONSTRAINT IN IMPROVING THE VERTICAL RESOLUTION, REDUCTION OF THE RETRIEVAL PROBLEM INTO A FREDHOLM LINEAR INTEGRAL EQUATION OF THE FIRST KIND AND ITS SOLUTION USING THE REGRESSION METHOD, AND COMPARISON OF THE RETRIEVED PROFILE WITH RADIOSONDE-ROCKETSONDE DATA ARE DISCUSSED. METHODS OF OBTAINING TEMPERATURE PROFILES IN THE PRESENCE OF CLOUDS USING SINGLE FIELD AND MULTIPLE FIELD OF VIEWS ARE PRESENTED. THE PRACTICES OF ACCOUNTING FOR GEOGRAPHICAL IMPOSITION OF HIGH TERRAIN AND THE EFFECT OF HOT TERRAIN AND A BRIEF MENTION OF THE EFFECT OF AEROSOLS ARE COVERED. A VERY SHORT ACCOUNT OF MICROWAVE REMOTE TEMPERATURE MEASUREMENTS IS ALSO INCLUDED (55 Refs)
Descriptors: TEMPERATURE MEASUREMENT; TEMPERATURE DISTRIBUTION; REMOTE SENSING; ATMOSPHERIC TEMPERATURE
Identifiers: CLOUDLESS CONDITIONS; CLOUDS; AEROSOLS; MICROWAVE REMOTE TEMPERATURE MEASUREMENTS; IR REMOTE TEMPERATURE MEASUREMENT; ATMOSPHERE; TEMPERATURE PROFILE RETRIEVAL; A PRIORI STATISTICAL CONSTRAINTS
Section Class Codes: A9385, A9265D, A9260

969309 ID NO.- EI790969309
INVERSE SCATTERING THEORY AND PROFILE RECONSTRUCTION.
Jordan, Arthur K.; Ahn, Saeyound
Nav Res Lab, Washington, DC
IEE Conf Publ n 169 pts 1 and 2, Int Conf on Antennas and Propag, London, Engl, Nov 28-30 1978. Publ by IEE, London, Engl, 1978 pt 2 p 51-55 CODEN: IECPB4
Inverse scattering theory is concerned with the mathematical description of an unknown region from the knowledge of the scattering data, for instance the incident and scattered electromagnetic waves. If the unknown region is an inhomogeneous medium whose refractive index varies in one spatial dimension, then the inverse scattering problem can be called profile reconstruction. A reconstruction method that provides closed-form expressions for the profiles of electron density from the analytic representation of the reflection coefficient is demonstrated. 14 refs.
DESCRIPTORS: (*ELECTROMAGNETIC WAVES, *Scattering),
IDENTIFIERS: QUANTUM SCATTERING
CARD ALERT: 711

174350 A79016574

TEMPERATURE HEIGHT PROFILE DETERMINATION BY AIRCRAFT MEASUREMENTS OF THE OUTGOING RADIO EMISSION OF THE EARTH-ATMOSPHERE SYSTEM

KITAI, SH.D.; SUMIN, M.I.; TROITSKII, A.V.

IZV. AKAD. NAUK SSSR FIZ. ATMOS. AND OKEANA VOL.14, NO.11 1131-8 NOV. 1978 Coden: IFAOAV

Trans In: IZV. ACAD. SCI. USSR ATMOS. AND OCEANIC PHYS. (USA) Coden: BSUAAZ

Treatment: THEORETICAL~

JOURNAL PAPER~

Languages: RUSSIAN

SOME PHYSICAL AND MATHEMATICAL ASPECTS ARE DISCUSSED OF SETTING AND SOLVING THE PROBLEM OF REMOTE SENSING OF TEMPERATURE HEIGHT PROFILES BASED ON ANGLE RADIOMETRIC MEASUREMENTS OF THE OUTGOING RADIO EMISSION OF THE EARTH-ATMOSPHERE SYSTEM IN THE REGION OF LAMDA=5 MM. RESULTS OF RETRIEVAL OF THE TEMPERATURE PROFILES FROM EXPERIMENTAL DATA ARE GIVEN. ACCURACY OF THE HEIGHT PROFILE DETERMINATION IS DISCUSSED (25 Refs)

Descriptors: ATMOSPHERIC TEMPERATURE; REMOTE SENSING; ATMOSPHERIC RADIATION

Identifiers: AIRCRAFT MEASUREMENTS; OUTGOING RADIO EMISSION; REMOTE SENSING; TEMPERATURE HEIGHT PROFILES; ANGLE RADIOMETRIC MEASUREMENTS; EARTH ATMOSPHERE SYSTEM; MM 0005; 5 MM WAVELENGTH; EHF

Section Class Codes: A9260

199661 A79031780

AN INVERSE PROBLEM FOR AN ABSORBING MEDIUM WITH MULTIPLE DISCONTINUITIES

KRUEGER, R.J.

UNIV. OF NEBRASKA, LINCOLN, NE, USA

Q. APPL. MATH. (USA) VOL.36, NO.3 235-53 OCT. 1978 Coden: QAMAAY

Treatment: THEORETICAL~

JOURNAL PAPER~

DEALS WITH AN INVERSE PROBLEM FOR WAVE PROPAGATION IN AN ABSORBING MEDIUM. THE MOTIVATION FOR THE WORK CAME FROM A ONE-DIMENSIONAL ELECTROMAGNETIC INVERSE SCATTERING PROBLEM IN WHICH THE CONDUCTIVITY SIGMA(Z) AND PERMITTIVITY EPSILON(Z) OF A SLAB OF FINITE THICKNESS SITUATED BETWEEN Z=0 AND Z=L WERE OBTAINED BY WORKING IN THE SPACE-TIME DOMAIN. EPSILON AND SIGMA ARE ALLOWED TO HAVE ANY FINITE NUMBER OF JUMP DISCONTINUITIES ON 0<Z<L, AS WELL AS BEING DISCONTINUOUS AT Z=0 AND Z=L. IT IS SHOWN THAT THE DATA FOR THE SOLUTION CAN BE OBTAINED FROM FINITE PORTIONS OF A SINGLE INCIDENT, REFLECTED AND TRANSMITTED WAVE. THE RECONSTRUCTION OF EPSILON AND SIGMA CAN THEN BE ACHIEVED BY SOLVING A LINEAR INTEGRAL EQUATION CONTAINING ADVANCE AND DELAY TERMS (10 Refs)

Descriptors: ELECTROMAGNETIC WAVE PROPAGATION

Identifiers: INVERSE PROBLEM; ABSORBING MEDIUM; MULTIPLE DISCONTINUITIES; WAVE PROPAGATION

Section Class Codes: A4110H, A0340K

214218 A79041490

AN ACOUSTIC INVESTIGATION OF STRATIFIED MEDIA USING ALGORITHMS FROM THE INVERSE SCATTERING PROBLEM IN QUANTUM MECHANICS

LEFEBVRE, J.P.

CNRS, MARSEILLE, FRANCE

REV. CETHEDEC (FRANCE) VOL.15, NO.56 99-105 1978

Coden: RCETA8

MEETING ON ACOUSTIC PROPAGATION 30-31 MAY 1978 MARSEILLE, FRANCE

Treatment: THEORETICAL~

REPORT SECTION~

Languages: FRENCH

THE AUTHOR PROPOSES A GENERAL INVESTIGATION METHOD FOR STRATIFIED MEDIA, WITH CONTINUOUS OR DISCONTINUOUS SPECIFIC IMPEDANCE PROFILES (ACOUSTIC IMPEDOGRAPHY). THE METHOD IS SUBDIVIDED INTO THREE STEPS' DECONVOLUTION GIVING THE IMPULSE RESPONSE, INVERSE SCATTERING PROCEDURE GIVING THE SCATTERING POTENTIAL AND CALCULUS OF THE ACOUSTIC IMPEDANCE PROFILE FROM THE SCATTERING POTENTIAL (13 Refs)

Descriptors: ACOUSTIC WAVE SCATTERING; ACOUSTIC IMPEDANCE

Identifiers: STRATIFIED MEDIA; SPECIFIC IMPEDANCE PROFILES; DECONVOLUTION; IMPULSE RESPONSE; SCATTERING POTENTIAL; INVERSE ACOUSTIC WAVE SCATTERING PROBLEM; PEKERIS EQUATION; SCHRODINGER EQUATION; ACOUSTIC WAVE PROPAGATION; ACOUSTIC IMPEDOGRAPHY

Section Class Codes: A4325

939415 ID NO.- EI790639415

THEORIE D'UNE METHODE QUANTITATIVE D'INVESTIGATION DES MILIEUX STRATIFIES: L'IMPEDOGRAPHIE ACOUSTIQUE. $left bracket$ Theory of a Quantitative Method to Investigate Stratified Media: Acoustic Impedography $right bracket$.

Lefebvre, J. P.

CNRS, Lab de Mec de d'Acoust, Marseille, Fr

Acustica v 41 n 1 1978 p 11-20 CODEN: ACUSAY

ISSN 0001-7884

A general method is proposed of the acoustical investigation of stratified media, showing either continuous or discontinuous profile: acoustic impedography. Neglecting the phenomena of absorption and dispersion, the Pekeris equation is used to describe the acoustical propagation with its transformation into the Schrodinger one to solve the inverse scattering problem of quantum mechanics. In order to use the preceding algorithms to determine the impulse response in reflection from the medium the method proposed is sub-divided into three stages: deconvolution to give the impulse response, the application of the algorithm of Gelfad-Levitan (or of Jost-Kohn if one prefers to work with frequency response) to give the scattering potential, and then the calculus of the acoustic impedance profile is obtained from the scattering potential. It is shown that the first iterate gives the same expression as that actually used by Jones in his $left double quote$ Ultrasonic Impediography $right double quote$ for the identification of biological tissue and also by Wright in his $left double quote$ Acousticore $right double quote$ derived for the surveying of sea-beds. Higher order iterations will automatically take into account multiple reflections occurring in all large impedance gradients, thus insuring the validity of the method for all complex configurations. Hence the method is applicable to all one dimensional acoustical investigations as varied as non-destructive testing, seismic, oceanographic or atmospheric prospecting and medical echography, and the convergence is very superior to that of the general optimal control procedure in seismology. 31 refs. In French with English abstract.

DESCRIPTORS: (*ACOUSTIC WAVES, *Mathematical Models), (ACOUSTIC VARIABLES MEASUREMENT, Impedance),

CARD ALERT: 751, 921

887653 ID NO.- EI781287653

EXAMINATION OF THE LIMITED APERTURE PROBLEM OF PHYSICAL OPTICS INVERSE SCATTERING.

Mager, Robert D.; Bleistein, Norman
Colo Sch of Mines, Golden

IEEE Trans Antennas Propag v AP-26 n 5 Sep 1978 p 695-699
CODEN: IETPAK

The limited aperture problem of physical optics inverse scattering is examined via the method of multidimensional stationary phase. It is shown that target information is recoverable from band-limited and aspect-limited scattering data. Numerical examples are presented for the case of a perfectly reflecting circular cylinder. 7 refs.

DESCRIPTORS: *ANTENNAS, CYLINDRICAL,
CARD ALERT: 716

288376 A79088835

NEW RESULT ON THE INVERSE SCATTERING PROBLEM IN THREE DIMENSIONS

NEWTON, R.G.
INST. FOR ADVANCED STUDY, PRINCETON, NJ, USA

PHYS. REV. LETT. (USA) VOL.43, NO.8 541-2 20 AUG. 1978
Coden: PRLTAO
Treatment: THEORETICAL~
JOURNAL PAPER~

UNDER THE ASSUMPTION THAT THERE ARE NO BOUND STATES, A SINGULAR LINEAR INTEGRAL EQUATION FOR THE SCATTERING WAVE FUNCTION IS DERIVED WHOSE KERNEL CONTAINS THE SCATTERING AMPLITUDE ONLY. THE EQUATION IS USED TO OBTAIN A REPRESENTATION OF THE POTENTIAL IN TERMS OF THE SCATTERING AMPLITUDE AND THE WAVE FUNCTION. THE FINAL RESULT IS A THREE-DIMENSIONAL ANALOG OF THE MARCHENKO EQUATION (5 Refs)

Descriptors: POTENTIAL SCATTERING
Identifiers: INVERSE SCATTERING PROBLEM; SINGULAR LINEAR INTEGRAL EQUATION; SCATTERING WAVE FUNCTION; SCATTERING AMPLITUDE; MARCHENKO EQUATION; THREE DIMENSIONAL ANALOGUE
Section Class Codes: A0365N, A0380

1004397 ID NO.- EI800104397

LIMITED APERTURE PROBLEM.

Perry, William L.
Tex A&M Univ, College Station

Model Simul Proc Annu Pittsburgh Conf v 9 pts 1-4, for 9th Annu Conf, Univ of Pittsburgh, Pa, Apr 27-28 1978. Publ by ISA, Pittsburgh, Pa, 1978 pt 3 p 885-892 CODEN: MSPCD4

One of the difficulties in the use of N. N. Bojarski's physical optics farfield inverse scattering method is that the viewing aperture is limited. In terms of the underlying mathematics of the method, this means that one is trying to determine a function from knowledge of its Fourier transform on a set of finite extent. In this paper, the uncertainties that arise in that situation are analyzed. 13 refs.

DESCRIPTORS: (*LIGHT, *Scattering),
CARD ALERT: 741

78101007
An inverse scattering transform for potentials of compact support
Portinari, Joao C.
Departamento de Matematica, Pontificia Universidade Catolica do Rio de Janeiro, Rio de Janeiro, Brasil
J. Math. Phys. (N.Y.)19(10),2100-2102 (OCT. 1978) CODEN: JMAPA
CPM: 7810-B-1186
WORK TYPE: THEORETICAL
PACS: *03.80
We consider the inverse scattering problem for the one-dimensional Schrodinger equation on the whole line, (dSUP(2)/dxSUP(2)) (phi) (x,k)+.kSUP(2)-V (x).(phi) (x,k) =0. In some applications, as for example in the synthesis of electromagnetic media, it is important to have sufficient conditions on the scattering data such that the corresponding potential has compact support in some prescribed interval. The scattering data traditionally used in connection with the above ISP have been either one of the reflection coefficients (we are assuming that the potential V does not support bound states) r and r-from the left and right, respectively. Although it is easy to obtain simple conditions on r (r) to ensure cutoff of the potential on the left (right), conditions on r (r) that guarantee cutoff on the right (left) are too complicated to be of any practical value. In this paper, we propose to use new scattering data, namely the ratio r/t (where r is either one of the reflection coefficients and t is the transmission coefficient), and give necessary and sufficient conditions for the corresponding potential to have support contained in .-a, a..

098912 A78058914, C78021020
ON A PROBLEM OF INVERSE SCATTERING IN OPTICS' THE DIELECTRIC INHOMOGENEOUS MEDIUM
ROGER, A.; MAYSTRE, D.; CADILHAC, M.
LAB. D'OPTIQUE ELECTROMAGNETIQUE, FACULTE DES SCI. ET TECHNIQUES, MARSEILLE, FRANCE
J. OPT. (FRANCE) VOL.9, NO.2 83-9 MARCH-APRIL 1978
Coden: JOOPDB
Treatment: THEORETICAL-
JOURNAL PAPER-
AN ATTEMPT IS MADE TO DETERMINE A DIFFRACTING OBJECT FROM A DIFFRACTION PATTERN. SPECIFICALLY THE INDEX PROFILE OF A DIELECTRIC LAYER BACKED BY A PERFECTLY CONDUCTING PLANE IS REQUIRED. THE MATHEMATICAL DIFFICULTIES ARE ANALYSED IN A RIGOROUS MANNER AND IT IS EXPLAINED WHY THE PROBLEM IS 'ILL POSED' IN THE SENSE OF HADAMARD (1932). A WEAK ERROR ON THE DATA CAN PRODUCE ON EXTREME ERROR ON THE OBJECT DETERMINATION. TO OVERCOME THIS DIFFICULTY, RECENT WORK BY TIKHONOV (1976) WAS CONSULTED. ON SEVERAL EXAMPLES IT IS SHOWN THAT THE NUMERICAL PROGRAM USED PERMITS THE INDEX PROFILE TO BE DETERMINED WITHOUT HYPOTHESIS OF THEIR SHAPES (12 Refs)
Descriptors: LIGHT SCATTERING; NUMERICAL ANALYSIS; PHYSICS COMPUTING; REFRACTIVE INDEX
Identifiers: INVERSE SCATTERING; DIELECTRIC INHOMOGENEOUS MEDIUM; DIELECTRIC LAYER; PERFECTLY CONDUCTING PLANE; NUMERICAL PROGRAM; REFRACTIVE INDEX PROFILE; NUMERICAL ANALYSIS
Section Class Codes: A4220G, A0260, C7320

160799 A79007081
DETERMINATION OF THE INDEX PROFILE OF A DIELECTRIC PLATE BY OPTICAL METHODS
ROGER, A.; MAYSTRE, D.
FACULTE DES SCI. ET TECH., CENTRE DE SAINT-JEROME, MARSEILLE, FRANCE
SOC. PHOTO-OPTICAL INSTRUMENTATION ENGR(S).
PROCEEDINGS OF THE SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS, VOL.136. FIRST EUROPEAN CONFERENCE ON OPTICS APPLIED TO METROLOGY 26-8 1978
26-28 OCT. 1977 STRASBOURG, FRANCE
Publ: SOC. PHOTO-OPTICAL INSTRUMENTATION ENGR(S). BELLINGHAM, WA., USA
VIII+376 ISBN 0 89252 163 5
Treatment: THEORETICAL-
REPORT SECTION-
DEALS WITH AN INVERSE SCATTERING PROBLEM AND SHOWS THAT IT IS POSSIBLE, FOR INSTANCE, TO DEDUCE THE INDEX PROFILE OF AN INHOMOGENEOUS PLATE FROM ITS REFLECTION COEFFICIENT (2 Refs)
Descriptors: LIGHT SCATTERING; REFRACTIVE INDEX; LIGHT REFLECTION
Identifiers: DIELECTRIC PLATE; INVERSE SCATTERING; INHOMOGENEOUS PLATE; REFLECTION COEFFICIENT; REFRACTIVE INDEX PROFILE
Section Class Codes: A4220, A0760H

Spectral and Scattering Inverse Problems

Montpellier-1 Univ. (France). Lab. de Physique Mathematique.
AUTHOR: Sabatier, P. C.
F1762H3 Fld: 12A, 8K, 72B, 48F STAR1715
Apr 78 56p
Rept No: PM/78/4
Monitor: 18

Abstract: The reconstruction of a differential operator from discrete spectra is reduced to its reconstruction from an S-matrix. This method makes it possible to solve the singular Sturm-Liouville problems which determine certain modes of a sphere. Results show that information on modes and scattering can be taken into account together. They are applied to the earth inverse problem and partial answers are given to a well-known conjecture. Finally, the relevance of the JWKB approximation to this kind of problem is succinctly discussed.

Scattering, Spectrum analysis, Sturm-Liouville theory, Elastic waves, Lame wave equations, S matrix theory, Spheres, Vibration mode

Identifiers: *Inverse scattering problem, Operators(Mathematics), Differential equations, Earth(Plant), WKB approximation, Inverse probes, NTISNASAE, NTISFNFR

N79-24244/2ST NTIS Prices: PC A03/MF A01

969557 ID NO.- EI790969557
RAY LAUNCHING AND OBSERVATION IN GRADED-INDEX OPTICAL FIBERS.
Barrell, Kevin F.; Pask, Colin
Aust Natl Univ, Canberra
J Opt Soc Am v 69 n 2 Feb 1979 p 294-300 CODEN: JOSAAH
ISSN 0030-3941
General mathematical and numerical results are given for graded-index optical fibers excited by parallel beams. The excitation of bound and tunneling rays and their influence on power transmission and impulse response are described. The relevance of the results to other problems such as fiber excitation by partially coherent sources and the appearance of fiber output faces is discussed. The graded-index fiber equivlent of the black-band phenomena in step-index fibers is described and an application to profile determination is considered.
DESCRIPTORS: *FIBER OPTICS,
CARD ALERT: 741

79120528
Inverse methods for elastic waves in stratified media
Berryman, James G.
Bell Laboratories, Whippany, New Jersey 07981
J. Appl. Phys.50(11),6742-6744 (NOV. 1979) CODEN: JAPIA
CPM: 8002-A-0160
WORK TYPE: THEORETICAL
PACS: *43.20, 03.40.K

Two methods of solving the inverse problem for elastic waves at normal incidence on horizontally stratified media are discussed: Goupillaud's equal-travel-time-layer approach, and Ware and Aki's inverse-scattering method. The scattering method is simplified by showing that the impedance is proportional to the square of the Jost solution at zero frequency. The scattering method is discretized and a recursion relation is found for the impedance. In the continuum limit, the two methods are equivalent where the impedance is continuous but nonequivalent at points of discontinuity. The scattering method assigns the arithmetic average across the jump to the jump point.

IDENTIFIERS: ELASTICITY; SOUND WAVES; STRATIFICATION; LAYERS; MATHEMATICAL MODELS; SCATTERING; IMPEDANCE; FREQUENCY DEPENDENCE; RECURSION RELATIONS; COMPARATIVE EVALUATIONS

412831 A80069580, C8002198
PROGRESS ON A MATHEMATICAL INVERSION TECHNIQUE FOR NON DESTRUCTIVE EVALUATION
BLEISTEIN, N.; COHEN, J.K
DENVER APPL. ANALYTICS, DENVER, CO, US
$WAVE MOTION (NETHERLANDS $VOL.2, NO. $75-8 $JAN. 198
Coden: $WAMOD
JOURNAL PAPER~

IN EARLIER WORK, COMPUTER OUTPUT WAS PRESENTED FOR SYNTHETIC PULSE-ECHO DATA WHICH WAS PROCESSED ACCORDING TO A MATHEMATICAL IMAGING TECHNIQUE. THIS TECHNIQUE WAS BASED ON THE PHYSICAL OPTICS FARFIELD INVERSE SCATTERING (ACRONYM, POFFIS) FORMALISM FOR SCATTERING BY VOLUME DEFECTS. HERE, A NUMBER OF THEORETICAL ADVANCES IN THE POFFIS FORMALISM ARE REPORTED, WITH ATTENDANT REVISIONS IN THE COMPUTER ALGORITHM. FIRSTLY, A REVISED POFFIS FORMALISM WAS DEVELOPED IN WHICH THE SURFACE OF THE SCATTERER IS DIRECTLY RELATED TO THE SCATTERING DATA. IN THIS FORMALISM, APERTURE LIMITED SCATTERING DATA YIELDS AN IMAGE OF A CORRESPONDING APERTURE OF THE SCATTERING SURFACE OF THE DEFECT. SECONDLY, THIS FORMALISM WILL ALSO YIELD AN IMAGE OF THE SCATTERING SURFACE OF A CRACK. THIRDLY, FOR TRUE AMPLITUDE DATA, THE IMPEDANCE OR REFLECTION COEFFICIENT MAY BE READ DIRECTLY FROM THE COMPUTER OUTPUT. RELATED TO THIS LAST RESULT WAS THE ELIMINATION OF AN *IMAGE FADING* PHENOMENON AT CERTAIN CRITICAL ANGLES. FOURTHLY, THE COMPUTER ALGORITHM, WHICH WAS ORIGINALLY DESIGNED TO PROCESS DATA FOR A SPHERICALLY SYMMETRIC *TRAILER HITCH*, WAS MODIFIED (AND TESTED) TO PROCESS DATA WHEN THE RANGE TO THE CENTER OF THE COORDINATE SYSTEM WAS DIFFERENT AT EACH OBSERVATIONAL ANGLE. FIFTHLY, THE ALGORITHM WAS MODIFIED (AND TESTED) TO PROCESS DATA WHEN THE AVERAGE PROPAGATION SPEED VARIED WITH ANGLE. IMPLEMENTATION ON A REAL DATA SET IS DISCUSSED ($1 Refs)

Descriptors: PHYSICS COMPUTING; EVALUATION; CRACK DETECTION; FOURIER ANALYSIS; ACOUSTIC WAVE SCATTERING
Identifiers: MATHEMATICAL INVERSION TECHNIQUE; PHYSICAL OPTICS FARFIELD INVERSE SCATTERING; VOLUME DEFECTS; COMPUTER ALGORITHM; APERTURE LIMITED SC ATTERING DATA; TRAILER HITCH; NONDESTRUCTIVE EVALUATION; SYNTHETIC PULSE ECHO DAT
Section Class Codes: A4320, A0230, A8170, C7320

321464 B80006326
DEVELOPMENT OF PHYSICAL OPTICS FAR FIELD INVERSE SCATTERING (POFFIS) AND ITS LIMITATIONS (RADAR IMAGING)
BOERNER, W.M.; CHUK-MIN HO
DEPT. OF ELECTRICAL ENGNG., UNIV. OF MANITOBA, WINNIPEG, CANADA
IEEE
1979 INTERNATIONAL SYMPOSIUM DIGEST. ANTENNAS AND PROPAGATION 240-3 1979
18-22 JUNE 1979 SEATTLE, WA, USA
Publ: IEEE NEW YORK, USA
37+390
Treatment: THEORETICAL~
REPORT SECTION~
THE HISTORICAL DEVELOPMENT OF VARIOUS EXISTING POFFIS IDENTITIES IS SUMMARIZED, AND THE APPARENT INCOMPLETENESSES OF THESE TECHNIQUES IS IDENTIFIED (21 Refs)
Descriptors: RADAR THEORY; PHYSICAL OPTICS; LIGHT SCATTERING
Identifiers: PHYSICAL OPTICS FAR FIELD INVERSE SCATTERING; RADAR IMAGING; POFFIS; LIGHT SCATTERING
Section Class Codes: B6310, B5210E

320850 A80009784, B80005509
N-DIMENSIONAL FAST FOURIER TRANSFORM TOMOGRAPHY FOR INCOMPLETE INFORMATION, AND ITS APPLICATION TO ELECTROMAGNETIC INVERSE SCATTERING THEORY
BOJARSKI, N.N.
IEEE
1979 INTERNATIONAL SYMPOSIUM DIGEST. ANTENNAS AND PROPAGATION 246 1979
18-22 JUNE 1979 SEATTLE, WA, USA
Publ: IEEE NEW YORK, USA
37+390
Treatment: THEORETICAL~
REPORT SECTION~
SUMMARY FORM ONLY GIVEN
Descriptors: ELECTROMAGNETIC WAVE SCATTERING; FOURIER TRANSFORM OPTICS
Identifiers: ELECTROMAGNETIC INVERSE SCATTERING THEORY; N DIMENSIONAL FFT TOMOGRAPHY; FAST FOURIER TRANSFORMS
Section Class Codes: A4110H, A4230K, B5210E

80010537
On three-dimensional inversion of P wave time residuals: Option for geological modeling
Christoffersson, A.; Husebye, E. S.
Department of Statistics, University of Uppsala, Uppsala, Sweden; NTNF/Norsar, Kjeller, Norway
J. Geophys. Res.84(B10),6168-6176 (10 OCT. 1979) CODEN: JGREA
WORK TYPE: THEORETICAL
PACS: *91.35.E, 91.35.G
In this paper some simple algorithms are introduced which give added flexibility to the Aki et al. (1977) inversion technique of two-dimensional travel time data. The new options include, besides computational efficiency, a block equalization scheme which may be used for smoothing poorly sampled blocks, testing whether geological surface contours have a counterpart in the deeper lithosphere and also to restrict the anomalous volume to parts of the lithosphere only. This novel computational scheme is demonstrated on a large Norsar data set, and the main results were as follows. Even a single heterogeneous layer at a depth of round 170 km, i.e., a two-dimensional model, gives a not unreasonable fit to the observational data (explained variance of the order of 60-65 per-cent), dominant surface geological features have no counterparts in the deeper lithosphere, though a seismic counterpart of the Oslo graben (associated with a marked gravity high) is found in the crustal layer. Changes in the basic model parameters like number and thickness of layers affect only the secondary features of the final three-dimensional seismic image of parts of the lithosphere. Physical smoothing of the final results in terms of equalizing poorly sampling blocks (e.g., number of hits less than 6) to nearby ones is demonstrated to be a viable alternative to introducing specific smoothing kernels.
IDENTIFIERS: SEISMIC P WAVES; EARTH CRUST ; EARTH MANTLE ; WAVE PROPAGATION ; INVERSE SCATTERING PROBLEM; THREE-DIMENSIONAL CALCULATION; COMPUTER CALCULATIONS

1011664 ID NO.- EI800211664
SINGULAR FUNCTION OF A SURFACE AND PHYSICAL OPTICS INVERSE SCATTERING.
Cohen, Jack K.; Bleistein, Norman
Univ of Denver, Colo
Wave Motion v 1 n 3 Jul 1979 p 153-161 CODEN: WAMOD9
It is shown how to recover both the location and the reflection coefficient of a scatterer using only high frequency backscattered data. The result is obtained without use of the far field approximation although a separate identity is derived when this approximation is introduced. This latter result improves upon previously derived physical optics far field inverse scattering identities. 15 refs.
DESCRIPTORS: (*ELECTROMAGNETIC WAVES, *Scattering).
CARD ALERT: 711

1036778 ID NO.- EI800536778
COMPARISON BETWEEN VARIOUS FIBRE CHARACTERIZATION TECHNIQUES.
Costa, Bruno
Cent Studi e Lab Telecomun, Torino, Italy
CSELT Rapp Tec v 7 n 4 Dec 1979 p 255-260 CODEN: CSELBY
The main characterization methods for optical fibers are examined, with a discussion on their relative advantages and disadvantages. In particular some recent results regarding the interpretation of back-scattering data are presented, as well as an evaluation of the applicability of the same method for splice loss measurement. The differential mode delay measurement technique and the reflectometric method for refractive index profile determination are also discussed. 20 refs.
DESCRIPTORS: *FIBER OPTICS, WAVEGUIDES, OPTICAL,
CARD ALERT: 741, 711, 714

803891 ORDER NO: AAD80-10358
CONSTRUCTIVE SOLUTION AND CHARACTERIZATION OF THE INVERSE SCATTERING PROBLEM FOR THE ONE-DIMENSIONAL ACOUSTIC WAVE EQUATION 120 PAGES.
GREENE, ROBERT REX (PH.D. 1979 NEW YORK UNIVERSITY).
PAGE 5297 IN VOLUME 40/11-B OF DISSERTATION ABSTRACTS INTERNATIONAL.
MATHEMATICS
DESCRIPTOR CODES: 0405
INSTITUTION CODE: 0146

302624 A79097214
THE INVERSE PROBLEM FOR RANDOM SOURCES
DEVANEY, A.J.
SCHLUMBERGER-DOLL RES. CENTER, RIDGEFIELD, CT, USA
J. MATH. PHYS. (USA) VOL.20, NO.8 1687-91 AUG. 1979
Coden: JMAPAQ
Treatment: THEORETICAL-
JOURNAL PAPER-
THE PROBLEM OF DEDUCING THE STATISTICAL STRUCTURE OF A LOCALIZED RANDOM SOURCE RHO(R) OF THE REDUCED WAVE EQUATION FROM MEASUREMENTS OF THE FIELD EXTERNAL TO THE SOURCE IS ADDRESSED FOR THE CASE WHEN THE MEASUREMENTS YIELD THE AUTOCORRELATION FUNCTION OF THE FIELD AT ALL PAIRS OF POINTS EXTERIOR TO THE SOURCE VOLUME AND THE QUANTITY TO BE DETERMINED IS THE SOURCE@S AUTOCORRELATION FUNCTION R/SUB RHO/(R/SUB 1/,R/SUB 2/)=(RHO*(R/SUB 1/)RHO(R/SUB 2/)). THIS PROBLEM IS SHOWN TO BE EQUIVALENT TO THAT OF DETERMINING R/SUB RHO/ FROM THE AUTOCORRELATION FUNCTION OF THE FIELD@S RADIATION PATTERN AND IS FOUND, IN GENERAL, NOT TO ADMIT A UNIQUE SOLUTION DUE TO THE POSSIBLE EXISTENCE OF NONRADIATING SOURCES WITHIN THE SOURCE VOLUME. NOTABLE EXCEPTIONS ARE THE CLASS OF DELTA CORRELATED (INCOHERENT) SOURCES WHOSE INTENSITY PROFILES ARE SHOWN TO BE UNIQUELY DETERMINED FROM THE DATA AND THE CLASS OF QUASIHOMOGENEOUS SOURCES WHOSE COHERENCE PROPERTIES CAN BE DETERMINED IF THEIR INTENSITY PROFILES ARE KNOWN AND VICE VERSA (17 Refs)
Descriptors: RANDOM PROCESSES; WAVE EQUATIONS; STATISTICAL MECHANICS
Identifiers: INVERSE PROBLEM; RANDOM SOURCES; STATISTICAL STRUCTURE; REDUCED WAVE EQUATION; AUTOCORRELATION FUNCTION; QUASIHOMOGENEOUS SOURCES; DELTA CORRELATED SOURCES

Problems by Mesh Adapting

Denver Univ., CO. Dept. of Mathematics.*Department of Energy. (9506799)
AUTHOR: Hagin, F.
F1943K3 Fld: 12A, 72B GRAI7922
1979 31p
Contract: EY-76-C-02-2482
Monitor: f8

Abstract: The numerical solution of linear Fredholm I integral equations of the type arising from various one-dimensional inverse scattering problems is addressed. Typically, when these equations are discretized, they lead to very ill-conditioned algebraic systems. It is shown that for these types of kernels a relatively simple mesh adapting scheme leads to very well-conditioned systems. Moreover, when the kernel is not known explicitly but must be generated by numerically solving a boundary-value problem, it is shown that an asymptotic analysis can extract the information to adapt this mesh successfully. 4 figures, 4 tables. (ERA citation 04:042136)

Descriptors: *Fredholm equation, Boundary-value problems, Coordinates, Numerical solution, One-dimensional calculations, Scattering

Identifiers: ERDA/990200, Integral equations, Inverse scattering, Numerical integration, NTISDE

COO-2482-10 NTIS Prices: PC A03/MF A01

250519 A79064189
THE SCALAR THEORY OF NONRADIATING PARTIALLY COHERENT SOURCES
HOENDERS, B.J.; BALTES, H.P.
ZENTRALE FORSCHUNG AND ENTWICKLUNG, LANDIS AND GYR ZUG AG, ZUG, SWITZERLAND
LETT. NUOVO CIMENTO (ITALY) VOL.25, SER.2, NO.7 206-8
16 JUNE 1979 Coden: LNUCAE
Treatment: THEORETICAL-
JOURNAL PAPER-
THE EXISTENCE OF NONRADIATING SOURCES IS CRUCIAL FOR THE UNIQUENESS OF RELATED INVERSE SOURCE PROBLEMS. SOURCES CAN BE DETERMINED FROM THE EMITTED RADIATION ONLY UP TO THEIR NONRADIATING PART. WHILE SUFFICIENT AND NECESSARY CONDITIONS ARE KNOWN FOR NONRADIATING DETERMINISTIC SOURCES, THE CORRESPONDING PROBLEM FOR THE STOCHASTIC SOURCES AND FIELDS OF ARBITRARY DEGREE OF COHERENCE HAS NOT BEEN STUDIED HITHERTO. THE AUTHORS PRESENT A SIMPLE FOURIER TRANSFORM CRITERION WHICH ALLOWS THEM TO CHECK WHETHER GIVEN SOURCE CORRELATIONS ARE NONRADIATING. MOREOVER THEY DEVISE A GENERAL PROCEDURE THAT ALLOWS THE CONSTRUCTION OF SUCH CORRELATIONS. THE KNOWN DETERMINISTIC RESULTS ARE REPRODUCED IN THE COHERENT LIMIT (I.E. FACTORIZING CORRELATIONS) (5 Refs)
Descriptors: QUANTUM OPTICS; FOURIER TRANSFORM OPTICS
Identifiers: SCALAR THEORY; NONRADIATING PARTIALLY COHERENT SOURCES; FOURIER TRANSFORM CRITERION
Section Class Codes: A4280, A4230K

311023 A80001109, B80001379
INVERSE SCATTERING THEORY AND PROFILE RECONSTRUCTION
JORDAN, A.K.; AHN, S.
NAVAL RES. LAB., WASHINGTON, DC, USA
PROC. INST. ELECTR. ENG. (GB) VOL.126, NO.10 945-50 OCT. 1979 Coden: PIEEAH
Treatment: THEORETICAL~
JOURNAL PAPER~
PRESENTS AN ANALYTIC METHOD FOR THE RECONSTRUCTION OF THE PROFILES OF REFRACTIVE INDEXES OF INHOMOGENEOUS STRATIFIED REGIONS. THE REFLECTION COEFFICIENT R(KAPPA) FOR TIME-HARMONIC ELECTROMAGNETIC WAVES IS REPRESENTED AS A RATIONAL FUNCTION OF KAPPA, THE WAVE NUMBER. 1-DIMENSIONAL INVERSE SCATTERING THEORY HAS BEEN APPLIED TO OBTAIN ANALYTIC, CLOSED-FORM EXPRESSIONS FOR THE PROFILE FUNCTIONS Q(X) FROM R(KAPPA). THE PROFILE RECONSTRUCTION METHOD IS DEMONSTRATED WITH A 3-POLE R(KAPPA), THAT RESULTS IN A Q(X) WHICH RESEMBLES AN IONOSPHERIC ELECTRON-DENSITY PROFILE PREVIOUSLY ANALYSED BY DIRECT SCATTERING METHODS. THE PRESENT COMMUNICATION GENERALISES PREVIOUS RESULTS TO OBLIQUE INCIDENCE AND COMPARES SEVERAL Q(X) OBTAINED FROM DIFFERENT RATIONAL APPROXIMATIONS TO R(KAPPA) (17 Refs)
Descriptors: ELECTROMAGNETIC WAVE SCATTERING; REFRACTIVE INDEX; IONOSPHERIC ELECTROMAGNETIC WAVE PROPAGATION; RADIOWAVE PROPAGATION
Identifiers: PROFILE RECONSTRUCTION; ANALYTIC METHOD; REFRACTIVE INDEXES; REFLECTION COEFFICIENT; INVERSE SCATTERING THEORY; PROFILE FUNCTIONS; INVERSE SCATTERING THEORY; REFRACTIVE INDEXES; ELECTROMAGNETIC WAVE SCATTERING
Section Class Codes: A4110H, A4220G, A9420B, B5210H, B5210C

376631 A80046346, B80019792
A REVIEW OF THE ONE DIMENSIONAL INVERSE SCATTERING PROBLEM FOR STRATIFIED INHOMOGENEOUS MEDIA
KAY, I.W.
IEEE
1979 INTERNATIONAL SYMPOSIUM DIGEST. ANTENNAS AND PROPAGATION 221-4 1979
18-22 JUNE 1979 SEATTLE, WA, USA
Publ: IEEE NEW YORK, USA
37+390
Treatment: GENERAL,REVIEW~THEORETICAL~
REPORT SECTION~
THE ONE-DIMENSIONAL INVERSE SCATTERING PROBLEM ARISES IN DETERMINING THE FREE ELECTRON DENSITY OF THE IONOSPHERE FROM VERTICAL RADIO SOUNDING DATA. THIS DATA IS USUALLY PRESENTED IN THE FORM OF A CURVE, REFERRED TO AS AN IONOGRAM, THAT GIVES THE VIRTUAL REFLECTION HEIGHT OF A NARROW PULSE AS A FUNCTION OF ITS CARRIER FREQUENCY (14 Refs)
Descriptors: IONOSPHERIC ELECTROMAGNETIC WAVE PROPAGATION; ELECTROMAGNETIC WAVE SCATTERING; REVIEWS
Identifiers: ONE DIMENSIONAL INVERSE SCATTERING PROBLEM;

Inversion of One-Dimensional Scattering Data Using Prony's Method

California Univ., Livermore. Lawrence Livermore Lab.*Department of Energy. (9500007)
AUTHOR: Miller, E. K.; Lager, D. L.
F1911G4 Fld: 20N, 46 GRA17921
12 Feb 79 15p
Contract: W-7405-ENG-48
Monitor: 18

Abstract: A one-dimensional configuration is the simplest geometry to invert, yet it has practical application to such problems as scattering from inhomogeneous half-spaces and propagation on nonuniform transmission lines. Whether the medium parameters vary continuously or discretely with position, the problem's numerical description can usually be developed in finite-difference approximation. As such, the scattered and transmitted fields can be represented as exponential series, whose exponents are related to the electrical thicknesses of the layers which make up the model. If the exponents or poles are derivable from field data, then the inverse problem is formally solvable. This report considers application of Prony's method, a procedure for obtaining the poles of exponential signals, to such one dimensional problems. Both time-domain and frequency-domain data are analyzed. The effects of the medium characteristics, number of layers, and other factors are examined. It is concluded that Prony's method has merit for certain classes of one-dimensional inverse problems. 8 figures, 1 table. (ERA citation 04:039962)

Electromagnetic radiation, Dielectric materials, Finite difference method, Graphs, Layers, One-dimensional calculations, Reflection, Scattering, Series expansion, Singularity, Theoretical data, Transmission, Wave propagation

Identifiers: ERDA/657007, *Inverse scattering problem, Prony method, Transmission lines, NTISDE

UCRL-52667 NTIS Prices: PC A02/MF A01

799541 ORDER NO: AAD80-06921
ACOUSTIC INVERSE SCATTERING AS A MEANS FOR DETERMINING THE AREA FUNCTION OF A LOSSY VOCAL TRACT: THEORETICAL AND EXPERIMENTAL MODEL STUDIES 348 PAGES.
RESNICK, JEFFREY RICHARD (PH.D. 1980 THE JOHNS HOPKINS UNIVERSITY).
PAGE 4338 IN VOLUME 40/09-B OF DISSERTATION ABSTRACTS INTERNATIONAL.
PHYSICS, ACOUSTICS
DESCRIPTOR CODES: 0986
INSTITUTION CODE: 0098

320848 A80009802, B80005507
THE INVERSE SOURCE PROBLEM IN LIGHT SCATTERING
ROSS, G.; MOEZZI, H.; FIDDY, M.A.; NIETO-VESPERINAS, M.
PHYS. DEPT., QUEEN ELIZABETH COLL., UNIV. OF LONDON, LONDON, ENGLAND
IEEE
1979 INTERNATIONAL SYMPOSIUM DIGEST. ANTENNAS AND PROPAGATION 232-5 1979
18-22 JUNE 1979 SEATTLE, WA, USA
Publ: IEEE NEW YORK, USA
37+390
Treatment: THEORETICAL~
REPORT SECTION~
THE FUNDAMENTAL DIFFICULTY IN OBTAINING INFORMATION ABOUT A MEDIUM, THROUGH WHICH AN ELECTROMAGNETIC WAVE IS PROPAGATING,

320821 A80009783, B80005475
INVERSE PROBLEM WITH CAUSALITY BETWEEN SOURCES AND FIELD (ELECTROMAGNETIC WAVES)
SCHMIDT-WEINMAR, H.G.
DEPT. OF ELECTRICAL ENGNG., UNIV. OF ALBERTA, EDMONTON, CANADA
IEEE
1979 INTERNATIONAL SYMPOSIUM DIGEST. ANTENNAS AND PROPAGATION 228-31 1979
18-22 JUNE 1979 SEATTLE, WA, USA
Publ: IEEE NEW YORK, USA
37+390
Treatment: THEORETICAL~
REPORT SECTION~
THE AUTHOR PRESENTS COMPUTED SOLUTIONS TO TWO INVERSE SOURCE PROBLEMS BASED ON EXPANSIONS OF THE EXTERIOR FIELD THAT MAINTAIN A CAUSAL RELATION BETWEEN THE DISTURBANCES AT THE SOURCE POINTS AND THE FIELD POINTS' RECONSTRUCTION FROM FAR-FIELD DATA OF THE THREE-DIMENSIONAL DENSITY DISTRIBUTION OF THE SCATTERING POTENTIAL OF A SCATTERER COMPOSED OF SUBWAVELENGTH SOURCES, RECONSTRUCTION OF A PLANAR SUBWAVELENGTH SOURCE FROM FAR-FIELD DATA (5 Refs)
Descriptors: ELECTROMAGNETIC WAVE SCATTERING
Identifiers: INVERSE SOURCE PROBLEMS; ELECTROMAGNETIC WAVE SCATTERING
Section Class Codes: A4110H, B5210

Numerical Stability in an Inverse Scattering Problem

Wisconsin Univ-Madison Mathematics Research Center (221200)

Technical summary rept.
AUTHOR: Symes, W. W.
GO343I3 Fld: 12A, 72B, 46 GRAI8005
Aug 79 49p
Rept No: MRC-TSR-1990
Contract: DAAG29-75-C-0024
Grant: NSF-MCS78-09525
Monitor: 18

Abstract: The main result of this paper is a stability theorem for a certain class of difference algorithms designed to give approximate solutions of a model inverse scattering problem in one dimension. This stability result guarantees the convergence of the approximate solutions to the exact solution of the problem as the grid of the difference scheme is refined. The results of numerical experiments are presented based on one of these schemes, in which second-order convergence is observed. Furthermore the cost (that is, the dependence on N of the number of arithmetic operations required to compute the solution at N grid points) of the algorithms discussed below is essentially optimal.

Descriptors: *Inverse scattering, *Numerical methods and procedures, Difference equations, Stability, Convergence, Solutions(General), Algorithms, Volterra equations, Optimization

Identifiers: NTISDODXA, NTISNSFG

AD-A077 135/2 NTIS Prices: PC A03/MF A01

223676 A79044778
NONLINEAR APPROACH TO INVERSE SCATTERING
WESTON, V.H.
DIV. OF MATH. SCI., PURDUE UNIV., WEST LAFAYETTE, IN, USA
J MATH PHYS (USA) VOL.20, NO.1 53-9 JAN. 1979
CODEN: JMAPAQ
Treatment: THEORETICAL
JOURNAL PAPER
THE INVERSE SCATTERING PROBLEM FOR THE SCALAR WAVE EQUATION ASSOCIATED WITH PROPAGATION THROUGH A MEDIUM WHOSE INDEX OF REFRACTION DIFFERS FROM THAT OF FREE SPACE IN A REGION OF COMPACT SUPPORT IS TREATED WHEN THE SCATTERED DATA IS GIVEN FOR DIVERSE DIRECTIONS OF (PLANE WAVE) INCIDENCE, SCATTERED DIRECTIONS, AND FREQUENCIES. THE PROBLEM IS FORMULATED IN TERMS OF THE MINIMIZATION OF A NONLINEAR FUNCTIONAL WHICH IS BOUNDED BELOW, SUBJECT TO CONSTRAINTS. IT IS SHOWN THAT THE CONDITIONAL-GRADIENT METHOD MAY BE EMPLOYED, THE ITERATION PROCESS CONVERGING TO STATIONARY POINTS. THE LINEARIZED VERSION (CORRESPONDING TO THE PERTURBED WAVE EQUATION WITH ONLY THE LINEAR PERTURBED TERMS RETAINED) OF THE NONLINEAR FUNCTIONAL IS CONSIDERED AS A SPECIAL CASE. IN PARTICULAR THE LINEARIZED VERSION RELATED TO THE BORN APPROXIMATION LEADS TO SOME ADDITIONAL NEW RESULTS (11 Refs)
Descriptors: POTENTIAL SCATTERING; ITERATIVE METHODS
Identifiers: INVERSE SCATTERING; SCALAR WAVE EQUATION; INDEX OF REFRACTION; COMPACT SUPPORT; SCATTERED DIRECTIONS; FREQUENCIES; MINIMIZATION; NONLINEAR FUNCTIONAL; CONSTRAINTS; ITERATION PROCESS; STATIONARY POINTS; LINEARIZED VERSION; BORN APPROXIMATION; DIVERSE DIRECTIONS OF INCIDENCE; CONDITIONAL GRADIENT METHOD
Section Class Codes: A0365N, A0380

1062958 ID NO.- EI800862958
DISCRETE INVERSE METHODS FOR ELASTIC WAVES IN LAYERED MEDIA.
Berryman, James G.; Greene, Robert R.
Courant Inst of Math Sci, New York, NY
Geophysics v 45 n 2 Feb 1980 p 213-233 CODEN: GPYSA7
ISSN 0016-8033
The seismic inverse problem for waves at normal incidence on horizontally layered media is discussed. The emphasis is theoretical rather than practical, but some long-standing questions concerning the general applicability of the often taught Goupillaud inverse method are answered. In all, three

102769 ID NO.- EI71X002769
Density profile determination in a laser created plasma by an holographic method
BOBIN JL; BUGES JC; ROUZAUD P; TERNEAUD A
Commissariat a l'Energie Atomique, Villeneuve-Saint-Georges, France
9th Int Conf on Phenomena in Ionized Gases, Sept 1-6 1969, Bucharest, Rom. Contrib Pap by Acad Repub Soc Rom, 1969, Pap 5.3.1 p 638
DESCRIPTORS: (*PLASMAS, *Laser Generated), HOLOGRAPHY, (

(Item 23 of 27) User14763 22nov80 1242

PLASMAS, Measurements),
CARD ALERT: 744, 932

419935 A80073183

DETERMINATION OF THE INHOMOGENEOUS STRUCTURE OF A MEDIUM FROM ITS PLANE WAVE REFLECTION RESPONSE. II. A NUMERICAL APPROXIMATION

CANDEL, S.M.; DEFILLIPI, F.; LAUNAY, A.
ECOLE CENTRALE DES ARTS ET MANUFACTURES, CHATENAY-MALABRY, FRANCE

J. SOUND AND VIB. (GB) VOL.68, NO.4 583-95 22 FEB. 1980 Coden: JSVIAG

Treatment: GENERAL,REVIEW-THEORETICAL~

JOURNAL PAPER~

FOR PT.I SEE IBID., VOL.68, NO.4, P.571 (1980). CONCERNS A STANDARD ONE DIMENSIONAL INVERSE SCATTERING PROBLEM' GIVEN THE REFLECTION RESPONSE OF AN UNKNOWN INHOMOGENEOUS MEDIUM FOR PLANE WAVES UNDER NORMAL OR OBLIQUE INCIDENCE, DETERMINE ITS SOUND SPEED AND DENSITY STRUCTURES. THE PROBLEM IS SOLVED BY MEANS OF A SIMPLE NUMERICAL TECHNIQUE WHICH INVOLVES ONLY FAST FOURIER TRANSFORM OPERATIONS AND NUMERICAL INTEGRATION OF ORDINARY DIFFERENTIAL EQUATIONS. THREE CASES ARE SPECIFICALLY CONSIDERED' SOUND SPEED IS UNKNOWN, DENSITY IS KNOWN; SOUND SPEED IS KNOWN, DENSITY IS UNKNOWN; SOUND SPEED AND DENSITY ARE TO BE DETERMINED SIMULTANEOUSLY. NUMERICAL SIMULATIONS PERFORMED ON REFLECTION COEFFICIENTS COMPUTED PREVIOUSLY FOR A LIMITED BAND OF FREQUENCIES LEAD TO ACCURATE RECONSTRUCTIONS OF THE ORIGINAL STRUCTURES OF VARIOUS MEDIA (14 Refs)

Descriptors: WAVE PROPAGATION; NUMERICAL ANALYSIS

Identifiers: PLANE WAVE REFLECTION; NUMERICAL APPROXIMATION; INVERSE SCATTERING; REFLECTION RESPONSE; INHOMOGENEOUS MEDIUM; NUMERICAL INTEGRATION; ORDINARY DIFFERENTIAL EQUATIONS; REFLECTION COEFFICIENTS; FAST FOURIER TRANSFORMS; ELECTROMAGNETIC WAVES; ACOUSTIC WAVES; OCEAN SURFACE WAVES

Section Class Codes: A0340K, A0260

426825 A80077628

DETERMINATION OF THE INHOMOGENEOUS STRUCTURE OF A MEDIUM FROM ITS PLANE WAVE REFLECTION RESPONSE. I. A NUMERICAL ANALYSIS OF THE DIRECT PROBLEM

CANDEL, S.M.; DEFILLIPI, F.; LAUNAY, A.
ECOLE CENTRALE DES ARTS ET MANUFACTURES, CHATENAY-MALABRY, FRANCE

J. SOUND AND VIB. (GB) VOL.68, NO.4 571-82 22 FEB. 1980 Coden: JSVIAG

Treatment: GENERAL,REVIEW-THEORETICAL~

JOURNAL PAPER~

A NUMERICAL ANALYSIS OF WAVE PROPAGATION IN ONE DIMENSIONAL INHOMOGENEOUS MEDIA IS PRESENTED. THE AIM IS TO PROVIDE A NATURAL AND PHYSICAL BASIS FOR THE SOLUTION OF THE INVERSE SCATTERING PROBLEM IN ONE DIMENSION. THE PAPER INCLUDES A DISCUSSION OF SOME ASPECTS OF THE NUMERICAL SOLUTION OF THE DIRECT PROBLEM, TYPICAL RESULTS OF CALCULATION, AND A COMPARISON BETWEEN EXACT SOLUTIONS AND FORWARD SCATTERING APPROXIMATION (FSA) SOLUTIONS OF THE DIRECT PROBLEM. IT IS SHOWN THAT THE FSA ALLOWS ACCURATE CALCULATIONS OF THE REFLECTED WAVE (12 Refs)

Descriptors: WAVE PROPAGATION; NUMERICAL ANALYSIS

Identifiers: PLANE WAVE REFLECTION; NUMERICAL ANALYSIS; ONE DIMENSIONAL INHOMOGENEOUS MEDIA; INVERSE SCATTERING PROBLEM; FORWARD SCATTERING APPROXIMATION; FSA; WAVE THEORY; ELECTROMAGNETIC WAVES; ACOUSTIC WAVES; OCEAN SURFACE WAVES

Section Class Codes: A0340K, A0260

80090598
On the construction of well-conditioned systems for Fredholm I problems by mesh adapting
Hagin, Frank
Department of Mathematics, University of Denver, Denver, Colorado 80208
J. Comput. Phys.36(2),154-169 (1 JUL. 1980) CODEN: JCTPA
WORK TYPE: THEORETICAL
PACS: *02.60.N
The paper addresses the numerical solution of linear Fredholm I integral equations of the type arising from various one-dimensional inverse scattering problems. Typically when these equations are discretized they lead to very ill-conditioned algebraic systems. It is shown that for these types of kernels a relatively simple mesh adapting scheme leads to very well-conditioned systems. Moreover, when the kernel is not known explicitly but must be generated by numerically solving a boundary-value problem, it is shown that an asymptotic analysis can extract the information necessary to successfully adapt this mesh.
IDENTIFIERS: NUMERICAL SOLUTION ; KERNELS; BOUNDARY-VALUE PROBLEMS; INVERSE SCATTERING PROBLEM; FREDHOLM EQUATION

395198 A80057127
INVERSE SCATTERING. I. ONE DIMENSION
NEWTON, R.G.
PHYS. DEPT., INDIANA UNIV., BLOOMINGTON, IN, USA
J. MATH. PHYS. (USA) VOL.21, NO.3 493-506 MARCH 1980
Coden: JMAPAQ
Treatment: THEORETICAL-
JOURNAL PAPER-
THIS PAPER PRESENTS TWO NEW METHODS OF RECONSTRUCTING AN UNDERLYING POTENTIAL IN THE ONE-DIMENSIONAL SCHRODINGER EQUATION FROM A GIVEN S-MATRIX. ONE OF THESE METHODS IS BASED ON A GEL*FAND-LEVITAN EQUATION. THE OTHER ON A MARCHENKO EQUATION. A SEQUEL OF THIS PAPER WILL TREAT THE THREE-DIMENSIONAL CASE BY SIMILAR METHODS (29 Refs)
Descriptors: POTENTIAL SCATTERING; SCHRODINGER EQUATION
Identifiers: UNDERLYING POTENTIAL; SCHRODINGER EQUATION; S-MATRIX; ONE DIMENSIONAL INVERSE SCATTERING
Section Class Codes: A0365N, A0365G

440410 A80086130
INVERSE SCATTERING. II. THREE DIMENSIONS
NEWTON, R.G.
PHYS. DEPT., INDIANA UNIV., BLOOMINGTON, IN, USA
J. MATH. PHYS. (USA) VOL.21, NO.7 1698-715 JULY 1980
Coden: JMAPAQ
Treatment: THEORETICAL-
JOURNAL PAPER-
FOR PT.I SEE IBID., VOL.21, P.493 (1980). ASSUMING THAT A SCATTERING AMPLITUDE, GIVEN AS A FUNCTION OF THE ENERGY AND THE DIRECTIONS OF THE INCIDENT AND SCATTERED PARTICLES, IS ASSOCIATED WITH A LOCAL POTENTIAL WITHOUT SPHERICAL SYMMETRY VIA THE SCHRODINGER EQUATION IN THREE SPACE DIMENSIONS, THIS POTENTIAL IS UNIQUELY RECONSTRUCTED BY TWO METHODS. ONE IS BASED ON A GENERALIZATION OF THE MARCHENKO EQUATION; THE OTHER, ON A GENERALIZATION OF THE GEL*FAND-LEVITAN EQUATION (26 Refs)
Descriptors: POTENTIAL SCATTERING; SCHRODINGER EQUATION
Identifiers: SCATTERING AMPLITUDE; FUNCTION; ENERGY; INCIDENT; SCATTERED PARTICLES; LOCAL POTENTIAL; SPHERICAL SYMMETRY; SCHRODINGER EQUATION; MARCHENKO EQUATION; INVERSE SCATTERING; GEL*FAND LEVITAN EQUATION
Section Class Codes: A0365N, A0365G